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THE  
**GARDENS' BULLETIN**  
STRAITS SETTLEMENTS

Vol. XI

31st May, 1939

Part 1

**AMENDMENTS PROPOSED TO THE INTERNATIONAL  
RULES OF BOTANICAL NOMENCLATURE (1935)**

by C. X. FURTADO,  
*Botanic Gardens, Singapore.*

**1. Introductory Remarks**

1. In proposing amendments to the Rules, I make the following distinctions in names: valid and invalid, priorable and impriorable, legitimate and illegitimate.

2. **VALID AND INVALID.** Names that are invalid have no status under the Rules and therefore no claim to recognition by botanists (Art. 19A of present amendments<sup>1</sup>). Such names are easily recognized by their defects in one or more of the points enumerated in Art. 2B (for exception *see* para. 3 below). The names that satisfy the Rules on all the points concerning validity are called valid (Arts. 2B and 19A).

3. The main and really important difficulty in connection with judging the validity of names concerns the quality of their description, which, while it may be considered by some as sufficient to validate a name, by others may be judged insufficient (*see* FURTADO in *Blumea*, Suppl. 1, 1937 pp. 128-132). But provision has been made in these amendments for empowering the Congress to declare, by means of a decision, the validity or invalidity of such questionable names (Art. 21B-b), so that they may not "throw science into confusion" (Art. 4).

4. **PRIORABLE AND IMPRIORABLE.** It is admitted in the Rules that the use of certain valid names "may cause error or ambiguity" in nomenclature (Art. 4). Such

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<sup>1</sup> Where letters A, B, etc. follow the number of Articles quoted in this discussion, the reference is to the present proposed amendments.

names are rejected simultaneous homonyms, later homonyms of equal rank and later non-typonymous (formal) homonyms of unequal rank (Arts. 61A & B). These are the only valid names (besides those on which a special decision has been made by the Congress) that I consider should be impriorable, that is, they must not be included in priority considerations (Arts. 56A, 61A & B).

All other kinds of valid names, including those published in violation of the priority rule (Art. 56A), can be used without causing "error or ambiguity" in nomenclature, provided they are well typifiable. These should in my opinion be included in priority considerations (priorable names).

If not certainly typifiable, or if their inclusion in priority considerations would cause either confusion or many undesirable changes in the current nomenclature of plants, the Congress is empowered to suspend in such cases the rule of priority and prevent the changes. (Arts. 21 A-D and 62A).

No doubt the existence of well typified or well-typifiable synonyms causes much inconvenience, but under the new Rules they must be tolerated as a necessary though burdensome legacy from the past. As it will be seen later, this burden is made even greater by giving a valid status to such synonyms while denying them any claim to priority. Moreover the priority rule decides the legitimacy of names (*vide infra*), and its violation can render a name only illegitimate (*vide infra*). The priorability of names should therefore be decided without any reference to the priority rule, for this is applied only to such names as are priorable; hence it is fundamentally unsound to make priorability of names dependent in certain cases on the application of the priority rule.

5. **LEGITIMATE AND ILLEGITIMATE.** Names that are priorable may, under the present ruling, be either correct (legitimate) or incorrect (illegitimate), according to the circumscription, position and rank of the taxonomic group. A taxonomic group in given circumstances can bear only one legitimate name, the one that satisfies the priority rule (Arts. 16A and 56A). All other synonyms of the group under the circumstances are illegitimate names for the group.

6. A name published in contravention to the principles embodied in Arts. 16A, 17A-B, and 56A cannot be the oldest priorable name if the circumscription, position or rank given by its author is correct. Consequently occasions when it would be possible to legitimize such a name, or its epithet, will not often arise; but they may occur for instance when

older priorable names or epithets have later become unusable either in the required position or according to subsequent correction of typification or circumscription. But when such an occasion arises it would be better to allow the name or its epithet (if unambiguous and not to be abandoned because of a special decision of the Congress) to be legitimized on the principles of economy and seniority, as embodied in the priority rule (Art. 56A), than, by denying priorability to such a name, to complicate the application of the rules both of priority and of priorability. For the greatest objection against outlawing unambiguous valid names published in violation of the priority rules arises from nomenclatural jurisprudence itself, which, as shown in Section 1 above, cannot logically allow the priorability of names to become dependent on the application of a rule (the priority rule) which is applied only to priorable names or epithets; the violation of the rule of priority should only render a name illegitimate in the sense defined in these amendments.

Moreover no advantage is gained by denying priorability to such unambiguous specific names as are capable of rendering their later homonyms impriorable: on the contrary such a denial not only does not maintain the principle of economy in epithets but also creates a class of unusable names which are both valid and unambiguous. No doubt such names were unusable also according to the 1905-1910 Rules; but under those Rules such names were also invalid and so incapable of rendering their later homonyms impriorable. The 1935 Rules give valid status (Art. 37) to names published in contravention to the priority rule; and it is absolutely essential that the rules concerning validity, priorability and priority (or legitimacy) should not be confused so as to render their application difficult.

Moreover, as the example discussed below will show, there is no proper reason why certain offences against the priority rule should be singled out for penalization and others escape it.

### Example:

In a hypothetical case DOE describes a new monotypic genus called *Codactyla* DOE (1920) and publishes a non-validable specific name *C. floribus plenius longipedunculatus* DOE (1920). In 1921 ROE redescribes the genus as *Dactycola* ROE and renames the type species of *Codactyla* as *D. multiandra* ROE. Later in 1922 ROE describes another species *D. quinquefolia* ROE. In 1923, however, DOE claims priority to *Codactyla* DOE (1920) over *Dactycola* ROE (1921) and manifests his predilection to Greek by renaming the species *C. polyandra* DOE nom. nov. (*C. floribus plenius longipedunculatus* DOE = *D. multiandra* ROE) and *C. pentaphylla* DOE nom. nov. (= *D. quinquefolia* ROE).

Now here ROE was wrong, because the taxonomic group *Dactycola* as circumscribed by him included the type of *Codactyla* which name he ought to have adopted under one or more of the Rules not only as the correct name for the genus but also as the first part of the specific names. Consequently both *D. multiandra* and *D. quinquefolia* are "illegitimate" names under Art. 2. and the names or the combinations not being "strictly in accordance with the Rules" cannot be taken into consideration for the purposes of priority (Art. 45); and so *C. polyandra* and *C. pentaphylla* should be legitimized. But the definition of "illegitimate" names or combinations in Art. 60 of the 1931 Rules does not cover offences of this category; and, consequently, under Arts. 60 and 69, *D. multiandra* and *D. quinquefolia* are good priorable names and *C. pentaphylla* and *C. polyandra* must be rejected as "illegitimate" impriorable names.

Now a specific name consists of two parts and in my opinion there is no justifiable reason why an offence concerning the second part should be penalized and not the offence concerning the first part. Under the present Rules all the four specific names are valid; it is therefore but just that the names should be made priorable also. Normally the specific epithets created by DOE (1923) could not be legitimized because they are younger than the ones created by ROE; but circumstances may arise when ROE's epithets become non-legitimable under *Codactyla* (e.g. when they have been employed under *Codactyla* before transference to it of ROE's epithets). Under such circumstances rather than create new specific epithets and complicate the rule of priority, DOE's specific epithets *polyandra* and *pentaphylla* should be legitimized.

Dr. T. A. SPRAGUE's definition (approved by the Amsterdam Congress) of superfluous names reads thus: "A name is illegitimate 'if it was nomenclaturally superfluous when published, i.e. if the group to which it was applied, as circumscribed by its author, included the type of a name [or epithet?] which the author ought to have adopted under one or more of the Rules' (Art. 60, 1)." Under this definition *D. multiandra* ROE is a superfluous name because it includes the type of *Codactyla* DOE which ROE ought to have adopted "under one or more of the Rules" as the first part of the binomial; but *D. quinquefolia* ROE cannot (?) be called superfluous. Whether it was the intention of the legislators to include *D. multiandra* ROE as a superfluous name it is not clear.

7. HOMONYMS AND ORTHOGRAPHY. Owing to the varying taxonomic opinions of botanists, it is impossible to apply uniformly the old precept "once a synonym always a synonym." But the maxim "once a later homonym always a synonym" has been upheld in all names of equal rank and in all non-typonymous names of unequal rank where formal homonymy can occur under these amendments. It is therefore now no longer possible to invoke the plea of typonymy and illegitimacy of an earlier valid name in order to legitimize a later name having the same spelling and position and rank as the earlier name (Art. 61A & B).

8. I also submit that the Committee of Nomenclature might be empowered to investigate into the full consequences of the rules concerning homonymy and orthography of

names and to make some general rules by which botanists might be able to decide in the majority of cases whether or not a certain name is a homonym or a orthographic variant. I further submit that until this problem is fully reported upon, proposals for the rejection or conservation of homonymous names should not be approved. (see FURTADO in Gard. Bull. Straits Settl. IX, 1937 pp. 249-255). It is also necessary to decide whether or not the groups of epithets of the following category are homonymous: *javensis*, *javancensis*, *javana*, and *javanica*; *annamensis* and *annamitica*; *philippina*, *philippinensis*, *philippensis* and *philippica*; *ceylonensis*, *ceylanica*, *zeylanica*, *singalana*, *singalensis*, *singhalensis*, *sinhalensis*; *celebica*, *selebica* and *celebesiana*; *lisbonensis* and *ulyssiponensis*; *malayana*, *malauana*, *malajana*, *malayensis*, *malaiensis* and *malaisia*; *burmensis*, *birmanensis*, *birmensis*, *burmanica* and *birmanica*; etc.

9. In the proposed amendments which follow, I have gathered together all the provisions pertaining a particular aspect of the names of each kind of taxonomic groups in order to effect a condensation in the Rules. This condensation is desirable to prevent the invocation of one rule for defending the validity of a name which is invalid under another rule. (In some recent papers Art. 37 has been invoked to maintain as valid certain generic names which are invalid under Art. 42). The proposed re-arrangement would also enable anyone to detect more readily any flaws that later proposals might introduce into the Rules.

10. TAUTONYMS: I propose the elimination of the rule of tautonyms because the present definition, or its interpretation, is ambiguous. It is true that, in 1930 at Cambridge, tautonyms were rejected as invalid ("illegitimate" according to the terminology adopted in 1935 Rules) and the rule was later confirmed at Amsterdam (1935); but this rejection was apparently made without considering the status of many names that can be called tautonyms. It also appears that the intention of 1930 legislation was only to reject absolute tautonyms like *Linaria Linaria*, and *Radiola Radiola*, but not names like *Linaria Linariana*, *Radiola Radiolaris* and *Nasturtium Nasturtium-aquaticum*, though the last name is mentioned in the 1935 Rules as an example of invalid tautonyms. Moreover the rejection of absolute tautonyms was not considered in relation to the rule of the orthography of names (Art. 70); for though *Bradlea Braddleya*, like *Cuminum Cyminum*, may not be regarded as an absolute tautonym, yet when the generic names is spelt as *Braddleya*, which according to Art. 70 is a mere orthographic variant of *Bradlea*, then the correction

of *Bradlea Braddleya* would produce the absolute tautonym *Braddleya Braddleya*. And *vice versa*, the absolute tautonym *Braddleya Braddleya*, when corrected as to the generic name, would produce a non-tautonymous name *Bradlea Braddleya*.

An absolute tautonym must therefore be defined as a specific name in which the specific epithet is homonymous with the generic name. If this definition were admitted and if it were further admitted that *Asplenium Trichomanes* and *A. Trichomanes-dentatum* are not pairs of homonyms, then *Nasturtium Nasturtium-aquaticum* and *Radiola Radiolaris* cannot be regarded as absolute tautonyms; and *vice versa*, if *Nasturtium Nasturtium-aquaticum* were admitted as an absolute tautonym under this definition, then *A. Trichomanes* and *A. Trichomanes-dentatum* would have to be regarded as a pair of homonyms. It is therefore not possible to legislate on tautonyms without considering the rules of orthography and homonymy of names.

The objection that the admission of absolute tautonyms would involve many changes in the names that have become long current also holds good in the case of quasi-tautonyms; for formerly absolute tautonyms and quasi-tautonyms were treated on the same footing. And perhaps more name changes are involved by admitting quasi-tautonyms like *Cajanus Cajan*, *Kandelia Candel*, *Normanbya Normanbyi*, *Sullivantea Sullivantii* and *Timonius Timon* than by admitting absolute tautonyms.

Furthermore it should not be overlooked that, in the majority of cases, the existence of absolute tautonyms is a legacy of a nomenclatural system which did not regard the economy of epithets in naming taxonomic groups as a fundamental principle and which therefore permitted, in naming a new genus, the use of the oldest priorable epithet of the type species on which the new genus was based.

Now that economy in epithets has become a fundamental principle in the new Rules, the correct procedure should have been to reject the generic names published in contravention to this principle. But since such a rejection is now not possible because it would involve many name changes, the remedy does not lie in outlawing the specific epithets which, by applying the principles of seniority and economy to the epithets of unambiguous (priorable) names, have produced, or would produce, absolute tautonyms. It would be indeed advantageous to admit the tautonyms in such cases, for they would help to indicate the generic types. However, the advisability of restricting their employment in future only to name the generic types

might be considered. It may be remarked here that zoologists have found it useful to admit all tautonyms as valid legitimate names.

In view of these considerations it appears to me that the decision to outlaw indiscriminately all absolute tautonyms is not only arbitrary but also impracticable and in many cases disadvantageous to the present nomenclatural system. The decision is also against the principle which directs that "the rules of nomenclature should be . . . . . founded on considerations sufficiently clear and forcible for everyone to comprehend and be disposed to accept" (Art. 3).

#### 11. NOMINA CONSERVANDA AUT REJICIENDA.

An amendment to the Rules is here proposed for eliminating the possibility of securing the conservation of a name under false pretexts and of then claiming for the conserved name a force far in excess to that given to it by the Congress. (Art. 21A-B). Under the 1935 Rules the conservation of a name secured merely on orthographical grounds could have been used to render non-legitimable or impriorable its earlier synonyms and homonyms. Under the present proposed Amendments this contingency would not be possible.

12. Further, the generic names rejected *vis-à-vis* a nomen conservandum are termed at present nomina rejicienda; but the names thus rejected can be legitimized when they are neither homonymous nor synonymous with any of the conserved names. Yet nomina ambigua and nomina confusa are also regarded as nomina rejicienda, though they can never be legitimized. This equivocation or ambiguity is removed in the present proposals by adopting a classification which shows the precise effects of a Congress decision to conserve or to reject a name (Art. 21B).

13. I also submit that the Committee may be empowered to explore into the problem with a view to establishing some definite principles by which to appreciate the proposals concerning the conservation of names under Art. 21B-C. Until this is done I submit that no name should be permanently added to the lists of nomina conservanda made in 1905-1912 except to protect a use of a name current for a hundred years or more (*see* FURTADO in Gard. Bull. Straits Settl. X, 1939 pp. 180-181). The list of 1905-1912 and the names which have more recently been conserved on orthographic grounds should be re-arranged so as to conform with the proposed amendments in Art. 21B.

14. NOMINA AMBIGUA. The rule of nomina ambigua (Art. 62) is here revised so as to conform with its

original meaning. There has been of late a tendency to attach little or no importance to the word "permanent" in the rule. This, coupled with the abbreviation of the discussion given under *Rosa villosa*, has enabled the newer interpretations of the rule to pass as equivalent to the correct and traditional one. But from the discussion given of *Rosa villosa* under the 1905-1910 Rules and from the remarks elicited from eminent nomenclaturists who attended the 1930 as well as the 1935 Botanical Congress, it is evident that the legislators intended to consider as nomina ambigua only those names which have not only owing to their use in different senses, become a source of confusion, but also are admittedly incapable of any certain interpretation, so that the impossibility of removing the existing confusion is generally conceded to be *permanent*. On the other hand the Rules provide for disregarding all interpretations (irrespective of their number and of the length of their currency) if they are contrary to the type (Arts. 18 & 50-55). The existence of certainly identifiable types is also recognized as the chief means of correcting misinterpretations or misapplications of names.

15. TWO NEW APPENDICES: In 1935 at Amsterdam a proposal to invalidate certain works was put before the Botanical Congress by Dr. A. J. WILMOTT; but the Congress, regarding a statistical investigation into the effects of the proposal upon the current nomenclature as an essential preliminary to its consideration, referred the proposal to a special Committee for the necessary exploration. The task assigned to the Committee is not a light one, and it is doubtful whether all the necessary data will become available at the next meeting of the Congress. Hence in Arts. 21c-d means are proposed by which the principal aim of Dr. WILMOTT'S proposal might be secured without the statistical data.

The principal object of the proposal evidently is to prevent botanists from delving into the works proposed for invalidation in order to resuscitate generic and specific names, or their interpretations, such as might lead to many changes in the long established nomenclature and thus greatly impede botanical research. An examination of the opinions expressed on Dr. WILMOTT'S proposal and of similar ones submitted at previous Congresses by several botanists (cf. also SPRAGUE, Preliminary Opinions, 1935 p. 5) reveals no objections either to the principle, or to the main purpose, of the proposal. Consequently both its principle and its purpose may be taken to have the approval of botanists in general.

The importance of the principle underlying the proposal lies in the fact that it recognizes implicitly the existence of some strong reasons why certain works were either generally ignored, or allowed only a partial validity, by contemporary and subsequent botanists, and consequently, that it is now inconvenient, if not unreasonable, to force the entire nomenclature from such works upon the modern botanist, even if he has pledged himself to the rules of priority and retroactivity.

Just as a provision has been made in Art. 21 of the Rules to suspend in certain cases, the undesirable effects of the rules of priority and retroactivity, so also a provision appears to be necessary against the undesirable consequences of having to accept as valid the works, or some names in them, which had been generally disregarded by previous botanists. A suitable provision in the Rules, to guard against such a contingency, would also induce botanists to consider the advisability of denying validity to obscure tracts such as they may have unearthed from a long botanical oblivion and to prevent them from basing on these tracts changes in the long established nomenclature of plants.

The two proposed new Articles, each with its own Appendix, would secure this result. Art 21-C practically embodies the whole of Dr. T. A. SPRAGUE'S suggestion made in the *Preliminary Opinions* (1935 p. 8); and Art. 21D is aimed to secure the invalidation of the long disregarded names in works proposed for rejection by Dr. WILMOTT. But it may be remarked that the binomial combinations adopted in GANDOGGER'S *Flora Europae* for the subdivisions of species must be rejected as invalid, because they are not formed in accordance with the Rules which prescribe trinomials or multinomials for the taxonomic groups below the rank of species (Art. 28). Hence the binomials cannot be included in consideration of homonymy. Even if the question of their valid formation were overlooked, their existence could not be invoked to render impriorable specific names which are later orthographical homonyms of the "ternary" binomials; for the rule of homonymy operates only when the names considered are of the same rank (Art. 61) or formally of the same rank (Art. 61A-B). The principle involved here is the same which prevents the activation of the rule of homonymy against generic names when confronted with homonymous earlier universal designations for species. The fear that GANDOGGER'S binomials for the subdivisions of species, if not invalidated by a special decision of the Congress, "are likely to necessitate the rejection of a large and increasing number of names by

Art. 61 (later homonyms)" (SPRAGUE *l.c.*) is, therefore, unfounded. Hence the necessity of including GANDOGHER'S work in this Appendix X should be further explored.

16. HYBRIDS. The Rules seem to be rather ambiguous on the status of the names of hybrids, and current practice is too contradictory to be of any use in expounding the correct application of the Rules.

One school of botanists would associate the name of a hybrid with the taxonomic group represented by the type and would disregard all proofs and speculations concerning the hybridity or origin of the group. "The purpose of giving a name to a taxonomic group," they would say, "is not to indicate the characters or the history of the group, but to supply a means of referring to it" (Art. 15). This contention accords fully with another fundamental principle in nomenclature which requires every name to be associated with the type of its description, the ultimate type of every description being a specimen (Arts. 18 and 50-55).

But another school of botanists would disagree with this view and would change the name of a hybrid every time a different ancestry were attributed to the hybrid, even when the ancestry were different nomenclaturally only and not taxonomically. This procedure allows not only the association of names of hybrids with their parents or ancestors in place of the taxonomic group represented by the type specimen, but also the creation of names to cover hypothetical groups which have not been produced at present and which might never be produced in the future. Thus, according to this view, the name *Cistus Skanbergii* LOJAC, published on the assumption that it represented a good species, ought to have been changed when TURRIIL considered it to represent a hybrid between *C. monspeliensis* and *C. parviflorus* (Bot. Mag., 1938, t. 9514); similarly the name *Amelasorbis Jackii* REHDER, published on the assumption that it represented a hybrid between *Amelanchier florida* LINDL. and *Sorbus sitchensis* ROEM., ought to have been changed when JONES considered it to be a hybrid between *Amelanchier florida* and *S. scopulina* (GREENE (Journ. Arnold Arb. XX, 1939 p. 22)), even though it may not be possible to produce any cross between the parents originally indicated for this hybrid. The reason why the botanists of this school ignore the fundamental principles respected by the botanists of the first-mentioned school, is that hybrids, according to their view, are pseudo-taxonomic groups and not real taxonomic groups, though for the purposes of homonymy they claim for the names of hybrids equal footing with the names of non hybrid groups of the

corresponding rank. They defend their contention on the following provisions:

"All plants raised by crossing the same two species receive the same 'specific' name, variations between the seedlings being indicated where necessary by varietal names. . . . ."  
(Appendix VII-g).

"All hybrids. . . . . between the same two genera bear the same 'generic' name" (Art. 32).

A curious anomaly in this procedure is that, while a proper description based on a type is considered as essential for the validation of a "specific" name of a hybrid (though both the type and the description are to be ignored under this procedure should there be a change in the speculations concerning the parentage), a similar description is considered unnecessary, if not misleading, to validate a "generic" name of an intergeneric hybrid (the formula indicating the parents being considered as absolutely essential for its validation).

A third school of botanists would invalidate all names of hybrids of uncertain origin and quote the following in support of this their contention:

"If a Latin name has been given to a hybrid form of uncertain origin which cannot be referred to a Latin binomial, it must be treated like a vernacular (fancy) name; e.g. *Rhododendron* 'Atrosanguineum' . . . . ."  
(Appendix VIII-f).

Here the rule is also ambiguous: Is the name to be invalidated only when the hybrid is of uncertain origin, or when the name cannot be referred to a Latin binomial? If the former, then the procedure defended by this school of botanists is justified; if the latter, then the rule is superfluous because all non-binomial names of species (real or hybrid) are invalid. Or does it mean that names are invalid only when they satisfy both these conditions, so that a name has to be regarded as valid if it is either a Latin non-binomial denoting a hybrid of certain origin, or a Latin binomial denoting a hybrid of uncertain origin?

Obviously such a state of affairs is not conducive to the stability in nomenclature. And unless new fundamentals are clearly propounded to defend a contrary procedure, I submit that the procedure expounded by the first named school should be admitted as the correct one, because it complies with the fundamentals of the present nomenclature. Moreover it recognizes the well-known facts that it is sometimes possible either to produce the same kinds of hybrids from different pedigrees, or to obtain, from a progeny of a cross, plants which are exactly identical with either of the parents; consequently it is unsystematic either to distinguish the same kinds of plants by different names merely because they are of different ancestry, or to lump

together different kinds of plants under the same name merely because they have the same ancestry. The procedure recommended here, therefore, disallows a formula indicating the parents (real or putative) to take the place of the description required to validate a name under Art. 37.

The rejection of a formula as insufficient to validate the technical names of hybrids would also contribute to restore some order in the nomenclature of hybrids. Some gardeners, in publishing names to the hybrids raised by them, have deliberately assigned a wrong parentage in order to delay the production of the same hybrids by their rivals. Yet such names become current long before the public come to know of the true parentage. If the ordinary procedure of a description in Latin were required in the case of all valid names of hybrids of all degrees, the names created by gardeners would be technically invalid, unless they were also accompanied by appropriate descriptions; and so botanists would be able to straighten the nomenclature of the hybrids.

However in the case of "generic" names of intergeneric hybrids, this procedure, if approved, might provoke resentment among horticulturists: firstly, because they have come to associate such a "generic" name as a convenient abbreviation of a formula denoting the generic status of the hybrid; and secondly, because many such "generic" names, although established by reference to their parents only, have become long current and their rejection now would cause many name changes. In order, therefore, to avoid such name changes, it would be desirable to appoint a Committee to investigate the status of "generic" names of intergeneric hybrids and to recommend their conservation and typification where necessary.

On the other hand, an asexual "hybrid", if not a monstrosity falling within the meaning of the provision in Art. 65, is at least a compound or composite individual formed by the fusion or union of somatic parts of two or more individuals, each often retaining its specific character. In some respects an asexual "hybrid" is comparable to the compound individual resulting from a symbiotic or parasitic association of one organism with another: *e.g.* the association of the parasite *Cuscuta* with the host *Myrica*, or of the scion *Achras sapota* with the stock of *Mimusops hexandra*; and so such an individual cannot be regarded as representing a taxonomic group and should not have a valid name under the proposed Art. 22-C (cf also Art. 64). The names of asexual "hybrids" must therefore be given the same status as the horticultural names, which have no power to render their later homonyms impriorable.

However such chimaeras and the "monstrous" hybrids as are reproduceable by seed should become the subjects of a taxonomic inquiry even though their reproduction be by apomitic seed only; and so their names, if duly published by a description, should be nomenclaturally valid.

If these principles were admitted, appropriate changes in the wording of Arts. 31-31 would be necessary.

17. TYPES: I also submit that the nomenclature of types and the regulations to determine them as worked out by me in *Gard. Bull. Straits Settl.* IX 1937, pp. 285-309, may be considered by a special Committee with a view to investigating the feasibility of their being incorporated in Appendix I.

18. REPRESENTATIVE BOTANICAL INSTITUTIONS. I also submit that the Committee might consider the utility of working out a list of the Representative Botanical Institutions under Art. 36 on the principles elaborated by me in *Gard. Bull. Str. Settl.* IX 1937 pp. 273-279.

## 2. Amendments

(Where the letter A follows the number of an Article, the amendment is to the text of that Article in the existing Rules. Where other letters are used, the amendments are additions to or transpositions of the existing Rules).

Art. 2A: DELETE: "Names or forms of nomenclature contrary to a rule (*illegitimate names or forms*) cannot be maintained."

[This forms a rule by itself; moreover, the definition of an illegitimate name or form given here does not accord with its definition given elsewhere].

ADD the following to this Article: "Where necessary *notes* are added in order to make the meaning of the rules, or of the words used in them, unequivocal and precise."

Art. 2B: The rules are divisible into two main classes:

- (a) those dealing with fundamentals or validity, and
- (b) those dealing with applications or legitimacy.

- (a) The rules concerning validity of names are again divisible into the following groups: (1) the admissible order of the different taxonomic groups; (2) the formation of botanical names to denote these categories and their order; (3) the nature of a description or citation upon which the name may be based; (4) decisions of the Congress to meet special cases; (5) the nature of publications or literature, wherein the descriptions and names are published; and (6) the dates, the typification and the interpretation of names.

- (b) The rules of *legitimaćy* are divisible into the following groups: (1) the correct name for a given taxonomic group under given circumstances; (2) the correct orthography of names; (3) the correct gender of names; (4) priorability of names.

Art. 13A: DELETE the last sentence which is by itself a rule. (It is embodied in Art. 19A.).

Art. 16A: REVISE as follows:

Each taxonomic group with a given circumscription, position, and rank can bear only one *legitimate* name, the one that is in accordance with the type and priority principles (cf. Arts. 18A, 19B, 21B, 53A, and 56A).

Art. 17B: No one may change, modify, or refuse to accept a name, or epithet, merely because it is badly chosen, or disagreeable, or because another is preferable or better known.

[A name published in contravention to Art. 59 may still be valid and if so would be included in considerations of homonymy. Art. 59 is thus a commentary on Art. 17 and should be placed with it].

Art. 18A: In the first paragraph instead of "see Art. 66" in brackets READ: "see Arts. 50-52, 53B and Appendix I."

Art. 19A: REVISE the rule as follows:

Names, descriptions, publications, interpretations, typifications, or procedures contrary to a rule of validity are *invalid*, that is, they have no status under the Rules, and no claim to recognition by botanists; while those names, descriptions, etc., that satisfy every one of the validity rules are *valid*, that is, they have a status under the Rules and a claim to recognition by botanists. Names and descriptions denoting a classification contrary to Arts. 10-14 or published in invalid literature are not valid.

Art. 19B: Rules of legitimacy regulate the use of names which are valid under Art. 19A. The use of a valid name is correct or legitimate only if it satisfies every one of the legitimacy rules: otherwise the use is illegitimate.

Art. 20A: SUBSTITUTE for the first sentence the following:

No literature can be valid unless it is validly published (cf. Art. 36A). Valid botanical literature begins for the different groups of plants at the dates and with the books specified below:

Art. 21A: DELETE Notes 3 and 4 and Examples.

[It is desirable that every proposal for the conservation or rejection of names should be accompanied with an indication of its full force, so that decisions of the Congress may not be given a force far in excess to that given by the Congress. The Congress act on the premises submitted, so that if the premises are essentially invalid, the decision given under those premises should also be invalid. Thus, if the Congress were to conserve *Endlicheria* NEES (1833) (Lauraceæ) against *Endlichera* PRESL. (1832) (Rubiaceæ) on the assumption that these two are homonymous names, this decision should stand as long as the Rules permit botanists to consider these two names as homonymous, but not otherwise. If the two names were not homonymous and if it were still desired to abandon *Endlichera* PRESL. (1832) altogether, then a different decision of the Congress would be necessary and under the text of Art. 21 motives for outlawing the names would have to be explained. Further, even if *Endlicheria* and *Endlichera* were admittedly a pair of homonymous names, *Endlicheria* NEES (1833), if conserved against *Endlichera* PRESL. (1832), should not take precedence over all synonyms and homonyms which are older than *Endlichera* PRESL. (1832). Proposals for conservation or rejection of a name should be accompanied with the fullest possible details concerning the necessity for conservation or rejection especially now when there is a tendency among some botanists to split older genera so as to render a synonym of one into a legitimate name of another. It is also undesirable that the conservation of a name made only on grounds of orthography should be the means to invest that name with all the power embodied in Notes 3 and 4 which would render all its earlier synonyms and homonyms impriorable; if the latter was also desired, then the required data should be presented at the time of making the proposal. The amendments proposed below (Art. 21B) eliminate these undesirable elements in the original Art. 21].

Art. 21B: The conserved and rejected names must be classified in the following groups: (a) Orthographia nomenclum approbata; (b) Nomina rejecta aut invalidata; and (c) Nomina precedenda.

(a) *Orthographia nomenclum approbata*. The decisions given here affect only the orthography of the names placed in the list, but the dates of their publication (under the rejected orthography) are retained. Examples: Thus when *Humiria* JAUME ST. HIL. (1805) is conserved against *Houmiri* AUBL. (1775) on orthographic grounds, *Houmiri* AUBL. (1775) must be spelt as *Humiria* and its full citation is *Humiria* AUBL. (1775) emend. orth. JAUME ST. HIL. (1805) vice *Houmiri*. Similarly, *Heleocharis* R. BR. (1814) emend. orth. vice *Eleocharis*.

(b) *Nomina rejecta aut invalidata*. Names lose their valid status when placed here: if used again for

the same or another taxonomic group with adequate description, these have the status of new names.

[Certain names of a doubtful status (e.g. *nomina confusa*) and those that are generally ignored as insufficiently described (*nomina semi-nuda*, e.g. *Gigantothum* WILLD. 1859) should be placed here. Placing such names among *nomina invalidata* would save a good deal of trouble to botanists and avoid unnecessary changes in nomenclature on the grounds of priority or homonymy. Perhaps here could also be included the *nomina ambigua* as defined below in Art. 62A].

(c) *Nomina precedenda*: A name placed by the Congress in this category acquires a right of precedence in matters of priority or homonymy over certain other names specified in the decision and their later synonyms and homonyms, and over no others, provided the specified names over which precedence is given are either synonymous or homonymous with the *nomen precedendum*.

Examples: (1) In the Rules *Spergularia* J. & C. PRESL. (1819) has been conserved against *Buda* ADANS. (1763) and *Tissa* ADANS. (1763). This means that either of these names are to yield precedence to *Spergularia* whenever they are synonymous with the latter, but not otherwise. It also means that all later synonyms of *Buda* and *Tissa* cannot claim priority over *Spergularia*, even though they be earlier than *Spergularia* itself. But should there be a priorable synonym to *Spergularia* which is earlier than *Buda* or *Tissa*, it would be able to claim right of priority over *Spergularia* until special decision of the Congress makes it yield that right to *Spergularia*.

(2) If it is desired to conserve *Endlicheria* NEES (1833) (Lauraceæ) against *Endlichera* PRESL. (1832) on the grounds of homonymy, then the latter must be mentioned *vis-à-vis* the former. Such a conservation would make *Endlicheria* NEES (1833) take precedence over *Endlichera* PRESL. (1832) and its later homonyms, but would not give *Endlicheria* NEES (1833) precedence over the synonyms or homonyms that are *earlier* than *Endlichera* PRESL. (1832). But this decision would lose its validity as soon as an amendment were introduced in the Rules to make *Endlichera* PRESL. and *Endlicheria* NEES as non homonymous names.

Art. 21c: Works listed in Appendix IX are treated as invalid, because their acceptance would constitute a

serious impediment to botanical research. Only works of doubtful validity, or published posthumously thirty or more years after the deaths of the authors, or ignored generally by the contemporaries of the authors, may be listed in this Appendix.

(1) RAFINESQUE, *Antikon Botanikon*, 1810; (2) MOCINO et SESSÉ, *Flora Mexicana*, 1888 et 1891; (3) *ibid*, *Plantae Novae Hispaniae*, 1886 et 1893; (4) TEYSMANN et BINNENDIJK, (Plant Catalogue of the Buitenzorg Gardens), 1855; (5) Sir WILLIAM HUNTER, *Plants of Prince of Wales Island*, (ed. H. N. RIDLEY), 1909; (6) VOIGT, *Hortus Suburbanus Calcuttensis*, 1815; (7) Numerous Theses including those of some of the pupils of LINNAEUS, THUNBERG, etc., Catalogues, Nomenclators and Indexes which have been ignored in larger works up to very recent times: e.g. ROXBURGH, *Hortus Bengalensis*, 1811; MOON, *Catalogue of Indigenous and Exotic Plants of Ceylon*, 1821; ZINN, *Catalogus Plantarum . . . . . Gottingensis*, 1757; BURMAN, *Index to RUMPHIUS'S Herbarium Amboinense*, 1755 et 1769; STICKMAN, dissertation on RUMPHIUS'S *Herbarium Amboinense*, 1754 et 1759; BERZELIUS, dissertation on *Nomenclator Botanicus*, 1759; etc.

[Most of the names from the works listed in (7) should be invalid according to my interpretation of the Rules—see Gard. Bull. Straits Settl. X, 1939, pp. 162-172].

Art. 21D: Both generic and specific names published in the works listed in Appendix X are treated as invalid if they have consistently been either ignored, or reduced to synonymy, in monographs and important floristic works published between 1798 (the date of WILLDENOW'S *Species Plantarum*, Vol. I) and 1890 (the year preceding the publication of KUNTZE'S *Revisio*) both inclusive; but such names from books listed in Appendix X as have been either conserved in the Rules or used in one or more monographs or important floristic works (*i.e.* floristic works running to more than one volume) issued between 1798 and 1890 are treated as valid. Mere registration of names in nomenclators and indexes does not constitute their subsequent use under this rule. Only works published between 1753 and 1800 both inclusive may be included in this Appendix X.

[All works proposed for invalidation by Dr. WILMOTT in Appendix VIIbis of 1935 are to be included in this Appendix X provided the reasons given be satisfactory. See Preliminary Remarks, Sect. 15].

- Art. 22B: The long accepted interpretation of a name must not be disregarded without proofs or adequate botanical reasons. When retypification is necessary, under equality of circumstances, the lectotype or neotype selected must conform with the long accepted interpretation of the name.

*Note.*—By PROOFS or ADEQUATE BOTANICAL REASONS are meant reasons why the name must be attached to a particular taxonomic group and not to any others, or proofs that the description given under the name agrees with the taxonomic group newly identified with it and conflicts with the older identifications.

- Art. 25A: DELETE: "and written with an initial capital". (This belongs to the orthography of names. cf. Art. 70C).

ADD: But no generic name is valid unless: (1) it is intended definitely as a botanical name, and not merely a non-botanical designation of the genus; (2) when coinciding with a technical term currently used in morphology, it was both published before 1912 and accompanied simultaneously by one or more duly validated specific epithets under it; and (3) it is a univocal consisting either of a single word or of two or more words united or hyphenated when originally published.

ADD: Examples (1), (2) & (4) from Art. 67.

[This addition is from Art. 67 which would be better united with Art. 25. Reference to "unitary designation of species" is unnecessary, because specific names cannot be generic names, cf. also Art. 19A and Art. 27A].

- Art. 26A: READ: "Epithets denoting subgenera and section" instead of "Names of subgenera and sections" in the first line; and "Epithets denoting subsections" instead of "Names of subsections" in the second line.

ADD: It is permissible to reduce more complicated names to biverbal combinations provided an appropriate sign or word precedes the epithet to denote its category.

OMIT: "Agreeing in gender with the generic name and written with an initial capital".

[Since the old phrase "specific name" has given way to "specific epithet", it is necessary also to abolish the phrases "subgeneric name", "sectional name", etc., because the epithet denoting a subgenus, section, etc. is not the full name and cannot stand by itself without referring to the appropriate genus. The portions referring to gender and orthography are transferred to their appropriate sections].

Art. 27A: REVISE thus:

Names of species are binary combinations consisting of a valid name of the genus to which the species is referred followed by a single specific epithet. Symbols forming a part of specific epithets proposed by LINNAEUS must be transcribed. But no specific epithet is valid unless: (1) it is a univocal, consisting either of one word or of two or more words united or hyphenated at the time of publication (an epithet of two disunited or unhyphenated words being allowed as exceptions in books and papers in which univocal epithets have been generally employed); (2) it is intended definitely to be a botanical specific epithet and not merely a non-botanical designation; (3) it is not merely an ordinal adjective being used for enumeration; and (4) it is published in a work in which the binomial system of nomenclature for species as defined in the first sentence and the first alinea of this rule has been consistently employed (an occasional exception only in any work shall not render such work invalid).

ADD: Examples: (1), (2) and (4) in Art 68, but delete the last sentence in (4) because *Apocynum foliis Androsaemi* L. is a good binary binomial like *Adiantum capillus veneris* L. and *Atropa bella dona* L. discussed in Art. 27).

Art. 28A. OMIT: "When adjectival in form and not used as substantives, they agree in gender with the generic names."

[This has been transferred to the section on gender].

Art. 28B: No varietal or subvarietal epithet may be given to the variety of a species which includes the type.

Different ecologic variations in plants and in parts of plants belonging to species, subspecies, variety or sub-variety may be indicated with appropriate epithets preceded by the words *forma* and *subforma*; and the names thus formed are not reducible to simpler combinations without intercalating the epithet of the species, subspecies, variety or subvariety to which the forms belong.

*Note.*—When a species is interpreted *sensu lato* and it is desirable to indicate the division to which the type belongs, the type variety of the species may be indicated by repeating the specific name preceded by the prefix *eu* or by the epithet *typicus* or *genuinus* but none of these epithets shall have a status under the Rules.

Examples: The name *Nelosuma polynesianum* var. *typicum* H. J. LAM (Bern. Bishop Mus. Hawaii, Occ. Pap. XIV, 1938 p. 148) is invalid because it is given

to the type of *N. polynesicum* (HILLEBR.) BAILL. (1891), but the formæ *genuinum*, *longipetiolatum*, and *longipetiolatum* subforma *originarium*, published by Dr. LAM, under *N. polynesicum* sensu stricto are valid and are not formal homonyms (Art. 61B) of formæ *genuinum*, *longipetiolatum* and *genuinum* subforma *originarium* published respectively under *N. polynesicum* var. *glabrum* H. J. LAM (1938).

[The Rules do not admit a ternary system of names for species; and giving varietal and subvarietal names to the type variety amounts to giving a ternary name to it. Strictly speaking formæ and subformæ are not taxonomic groups, because the variations may be found even in the same individual, e.g. the bathyphyll and the acrophyll stages of figs, ferns and aroids. The names of formæ and subformæ should therefore be taken on the same footing as horticultural names of plants. Under Art. 30 some of Dr. LAM's formæ and subformæ would have to be renamed, while his var. *typicum* would be valid. The nomenclatural complications that would arise by admitting as valid varietal names to the type of a species have been discussed by me in Gard. Bull. Straits Settl. IX, 1937 pp. 242-244. That the use of such epithets as *typicus*, *genuinus*, *originarius*, *verus*, *viridicus*, etc. to form varietal names to the holotype of species produce undesirable complications have been shown by Dr. F. BOLLE (Notizbl. Bot. Gart. u. Mus. Berlin-Dahlem, XIII, 1937 pp. 524-530); and in the appendix to the same paper two divergent opinions, the one of Dr. T. A. SPRAGUE, and the other of Drs. H. HARMS, J. MATTFELD, and R. PILGER, have been recorded concerning the status of the epithets of the above mentioned category. Recently Drs. H. ST. JOHN and E. Y. HOSAKA (Bern. Bishop Mus. Hawaii, Occ. Pap., XIV, 1938 pp. 118-119) have shown that the typification of species becomes difficult, if epithets other than *typicus* (and perhaps also *genuinus*, *originarius*, *verus*, and *viridicus*) were accepted in giving ternary names to the holotypes of species. They have also tried to prove that, under Art. 60 (1) *Lobelia Gaudichaudii* var. *coccinea* ROCK (1917) is a superfluous name because it is an exact synonym of *L. Gaudichaudii* A. DC. pro parte typica, but they have not shown how their naming the type of the same species as *L. Gaudichaudii* var. *typica* ST. JOHN et Hos. (1938) with ROCK's trinomial as a synonym, is justified under the existing Rules].

Art. 30: DELETE. Incorporated in Art 61B. See remarks under Art. 28B.

Rec. XVIII: DELETE: Contradicts Art. 28B.

Art. 31-34: SEE Introductory Remarks, Section 16.

Section 5A: READ "valid" instead of "effective".

Art. 36A: READ "validated" for "effected", "valid" for "effective".

REVISE the 1935 amendment concerning the separates thus: "The issue of advance separates is not

valid unless their distribution satisfies the conditions required in Art. 36A concerning the sale or the private distribution of independent works."

ADD: "From 1912 no work published independently and offered for sale can be valid unless the author (or its publisher) either conforms with the requirements for books not placed on sale, or announces the work previous to, or simultaneously with, its issue in three botanical periodicals of international circulation to be specified under this rule, and unless he makes not less than 100 copies available to the botanical public.

"From 1912 new nomenclatural entities and new taxonomic descriptions will not be valid unless published in monographs or botanical periodicals and appropriately indicated as new.

[There are cases where new species have been published in school text-books, seed-lists, and political periodicals. *Elisabethua minata* Trev. nov. gen and nov spec. was for instance published in a political daily, *Gazzeta Ufficiale di Venezia*, n. 53 (1885, 6th March) p. 3. *Eryngium Grosii* F. Q. spec nov. was published in *Index Seminum quæ Hortus Botanicus Barcinonensis mutua commutatione offert*, 1938, p. 12. It is desirable to prohibit the publication of new nomenclatural entities in such books or periodicals].

Art. 37A: REVISE as follows:

A name of a taxonomic group is not valid unless it is (1) correctly formed, (Sect. 4), (2) published in valid literature (Arts. 20A & 36A), and (3) accompanied by (a) a valid description of the group (Notes 1-3), or (b) by a reference to a previous valid description of it published under either a valid or invalid but different name (Note 4), (see also Arts. 40A-B and 41A).

*Note 1.* Names in LINNAEUS'S *Species Plantarum* eds. 1 & 2, and in other books adopted as the starting points of valid botanical literature for different groups of plants cannot be rejected as invalid merely on the grounds of absence, or invalidity, of either description or reference. (see Art. 20A).

*Note 2.* The citation of the type locality or the peculiar habitat of a species is not sufficient to establish a name under this rule. If specific characters are given in addition to the type locality or the habitat, the type locality or the habitat becomes a part of the description and is to be considered as an important element in determining the identity of species. However economic uses and vernacular names do not become a

part of the description and so they cannot be used in determining the identity of species.

[Particulars concerning the locality and the nature of a habitat can, like the morphological characters of plants, be obtained or observed by an ordinary plant-collector in the field without any fear of a serious mistake, and can also be verified by subsequent collectors; but the particulars concerning the vernacular names and economic uses cannot be gathered in the field and the correctness of the information depends either on the collector's special ability, or that of his guides, to recognise the plants in the field and to associate them with economic uses].

*Note 3.* In this Article by the word description is meant a botanical description published in valid literature printed in any European language written in Roman characters if before 1935, or in Latin only if published after 1934, the two exceptions to this being the following:—

(A) In the case of *bacteria* and *fossil* plants, a description in any above-mentioned European languages is admitted. But from January 1st, 1912, no description of *fossil* plants can be valid unless it is accompanied (a) by illustrations or figures showing essential characters, or (b) by a reference to such illustrations or figures published previously in valid literature; if the required illustrations or figures are published after the description, then the later date alone must be taken into consideration for the purposes of the validity of the description or of its simultaneously published name.

(B) In the case of other (*recent*) plants, a *plate* or *figure with analyses showing essential characters* can take the place of a description provided it was published before 1908.

*Note 4:* (a) The reference must be made in the form of a conventional formula or expression intelligible to systematists in general, a full reference to the text and page being necessary when the citation is to a valid description published under an invalid name.

(b) In the case of a *generic name*, the reference must be to a previous valid description either published under another generic name (valid or invalid), or under any name (valid or invalid) of a generic subdivision of any category higher than a species.

(c) In the case of a *specific* (or *subspecific*) name, the reference must be either to a valid description published of the group under a subspecific (or specific) or another specific (or subspecific) name, or to a valid description of a monotypic genus provided the description (in the last case) is new and the name to be

validated is of the type species (*descriptio generico-specifica*). It is permitted to give the description of a new monotypic genus under the name of the type species.

ADD examples from Arts. 12, 13 & 11.

[At present the regulation which should form a part of Art. 37 is distributed to Arts. 38, 39, 42, 44 and 45].

Arts. 38 & 39: DELETE. Incorporated in Art. 37A.

Art. 10A: ADD: But it is permissible to validate alternative names (simultaneous isonyms) provided the alternative name is a combinatio nova equal in rank to its simultaneous basonym.

[The alternative names were declared valid at the Amsterdam Congress. But no provision was made against publishing alternative names of unequal rank or that are not new combinations, e.g. *Minima* gen. nov. vel *Mesembryanthemum* sect. *Minima* sect. nov.; *Cymbopogon riparium*, spec. nov. vel *C. fluminense* var. *riparium* var. nov. vel *C. riveriense* spec. nov].

Art. 10B: A name proposed provisionally (nomen provisorium) to be adopted by future investigators in case certain possible circumscription, position or rank be accepted, or merely mentioned incidentally, is not valid.

[This gives a more precise definition to the nomen provisorium than the one adopted at the Amsterdam Congress].

Art. 11A: ADD: An exception is made for the generic names published in LINNAEUS's *Species Plantarum* ed. 1 (1753) and ed. 2 (1762-1763) and in other books which have been adopted as the starting points of valid botanical literature for the different kinds of plants, so that the taxonomic groups in these books are treated as having been validly characterized. (*see* Art. 37A: Note 1).

Art. 42-44: DELETE. Incorporated in Arts. 37A & 41A.

Art. 45A: REVISE as follows:

"The date of a name or a combination is that of its valid publication (*see* Arts. 19A & 37A). In the absence of proof to the contrary, the date given in the work containing the name must be regarded as correct."

[DELETE the other parts of the rule as they are irrelevant here. cf. Arts. 37A & 61A-B].

Art. 50B: If the name of an order, suborder, family, subfamily, tribe or subtribe is taken from the name of a genus, the latter must be taken as the nomenclatural type of the former.

Examples as in Art. 66.

[This is Art. 66 revised. It forms a part of this Section].

Section 9A: REVISE the wording: Naming and interpreting taxonomic groups on transference to another position of the same rank.

[This Section should also deal with the names or epithets denoting the subdivisions of order or families].

Art. 53A: REVISE as follows:

When a taxonomic group is transferred to another nomenclatural position without change of rank, the epithet denoting the group must be retained or, if it has not been retained, must be re-established unless one of the following obstacles exists: (1) that there is available an epithet having a better claim under the priority rule (Art. 56A); (2) that the original name was not priorable (Art. 61B); (3) that the resulting combination is an impriorable homonym (Art. 61A-B).

If any of these obstacles occur, then the name or epithet must be legitimized which satisfies the rule of priority (Art. 56A).

[This combines the rules in Arts. 53, 54-55 partly, and 69 partly, from which the examples referring to this should be transferred here. The rule of tautonyms has been ignored (See Introductory Remarks, Sect. 10). In dividing this rule into many parts or Articles, not only no advantage is gained but many contradictory procedures are also made possible. Thus when in 1804 POIRET transferred *Pinus taxifolia* LAMB. (1803), non *Pinus taxifolia* SALISB. (1796), to *Abies*, Art. 51 obliged POIRET (retroactively) to make the combination *A. taxifolia*, and, if he had not made that combination, a subsequent author would have been justified in making the combination; but under Art. 69 POIRET was not obliged to make the combination *A. taxifolia*, nor would a subsequent botanist have been justified in making it if POIRET had adopted another combination for the species].

*Note.*—The oldest valid name on which the new combination is based is the *basinym* of the combination, and the new combination is the *isonym* of the basinym. All isonyms must be typified on the types of their respective basinyms. (see Art. 53B).

Art. 53B: When the epithet, on transference to another position, has been applied erroneously in its new position to a different type, the new combination must be retained for the type on which the epithet was originally based.

[The example of *Pinus Mertensiana* discussed at the Amsterdam Congress, 1935, should form a part of this Article].

Arts. 54 & 55: DELETE. Incorporated in Arts. 53A & 53B.

Art. 56A: REVISE as follows:

When two or more groups of the same rank are united, the oldest priorable name, or epithet, (Art. 61B) must be retained. When the epithet is not in the required position, it must be instated in that position

provided it does not produce an impriorable homonym; but if, when so placed, it would produce an impriorable homonym, then the next oldest priorable name or epithet that would not produce an impriorable homonym in the required position must be legitimized. If no such name, or epithet is available, then the author is at liberty to legitimize any epithet that becomes priorable in the new position, even an epithet from an invalid, or impriorable, name. For the nomenclature of Fungi with a pleomorphic life-cycle, see Art. 57.

If two or more priorable names, or epithets, have equal claim under this rule, precedence must be given to the name, or epithet, that is earlier in the correct position, or to a new combination over a new name (see also Art. 61A). In other cases the author who unites the groups has the right of choosing one of them as the legitimate name for the group; the author who first exercises the right under this, definitely treating one name as a synonym or a subordinate group of the other, must be followed, so long as the priority of the names is considered under the same position, but not otherwise.

ADD the following four examples:

(a) *Monospora grandifolia* HOCHST. and *M. rotundifolia* HOCHST. were published simultaneously in the same book (Flora, XXIV, 1841, p. 661). The isonyms to these two species under *Trimeria* Harv. (1838) are *T. grandifolia* (HOCHST.) WARB. (1893) and *T. rotundifolia* (HOCHST.) GILG (1921) respectively. When these two species are treated as synonymous, *T. grandifolia* (HOCHST.) WARB. (1893) is the correct name for the united group under *Trimeria*.

[Mr. E. MILNE-REDHEAD discussed the above case in Kew Bull. 1939, pp. 34-35. He appears, however, to have overlooked the fact that WARBURG, in uniting *Monospora* to *Trimeria*, by implication regarded *M. rotundifolia* as an unusable synonym. It may therefore fairly be argued that he was the first to select the name *M. grandifolia* for the species. There is also another decision earlier than GILG's, by DURAND and SCHINZ (Conspectus Fl. Afr. I, 2, p. 225).

An enquiry into the treatment of the specific epithets *grandifolia* and *rotundifolia* under the genus *Monospora* itself might lead to still further complications. The amendment above proposed, therefore, would furnish botanists with an easy means by which precise decisions could be given in such complicated cases, both without undertaking a lengthy investigation into the history of all rival names or epithets of equal age, and without violating the principle of priority].

(b) When *Rhizophora conjugata* L. (1753) and *R. gymnorrhiza* L. (1753) are united together under *Bruguiera*, precedence must be given to *B. gymnorrhiza*

(L.) LAM. (1797) over *B. conjungata* (L.) MERR. (1914) and any decisions given concerning the precedence of these two epithets under *Rhizophora* must be ignored.

(c) The combination *Talinum polyandrum* Hook. (in Bot. Mag., 1855, t. 4833), being a later homonym of *T. polyandrum* Ruiz. et Pav. (1798), is impriorable: when BENTHAM transferred *T. polyandrum* Hook. to *Calandrinia*, he called it *C. polyandra* (Fl. Austral. I. 1863 p. 172). Now *C. polyandra* (Hook.) BENTH. itself is not a later homonym, and so it is a priorable name. Since there is no earlier priorable name to the species, *C. polyandra* (Hook.) BENTH. becomes also its legitimate name.

(b) *Nicotiana? minima* PHIL. (1864) is impriorable because it is a later homonym of *N. minima* MOLINA (1782). But the name *Petunia minima* [PHIL.] REICHE (1910) is priorable although it is based on the impriorable *N. minima* PHIL. Hence *Combera minima* SANDW. (Hook. Ic. Pl., 1939, t. 3400) must be not only cited as *C. minima* (REICHE) SANDW. (or as *C. minima* ([PHIL.] REICHE) SANDW.), but also typified on the holotype of *N. minima* PHIL. in the Museo Nacional in Santiago, Chile.

[Mr. N. Y. SANDWICH has argued (cf. Arts. 54 and 69), that he was not bound to adopt the epithet *minima* when he transferred *N. minima* PHIL. = *Petunia minima* [PHIL.] REICHE to the genus *Combera*, that *C. minima* SANDW. should be called a nomen novum and not combinatio nova, and that a specimen in the Kew Herbarium should be taken as the holotype of *C. minima* SANDW.].

## Section 12A: REVISE: Priorability of Names.

Art. 59: DELETE: Incorporated in Art. 17B.

Art. 60: DELETE:

[The important part of this is incorporated in Arts. 2B, 19A & 19B, 36A, 37A & 61A & B. The rest is unnecessary and equivocal. In a code of rules one cannot enumerate the various ways in which an offence may be committed against the code, without adding to its bulk or creating ambiguity; but one can classify offences, according to their nature (cf. Arts. 19A, 19B). Besides by putting invalid names on the same footing as those valid names which have been published in violation of the priority rule much confusion has been created in the Rules].

Art. 61A: When there are two or more *simultaneous homonyms* (that is, when the same name, or its formal equivalent, is validly published simultaneously for more than one taxonomic group of equal rank), the first reviser who adopts one of them, or substitutes another name for one of them, must be followed, provided that

a new priorable combination having an older, or the oldest, priorable basynym of equal rank is given precedence. (*see* Art. 61B).

*Note 1.*—A *homonym* is a valid name identical with another valid name, or an orthographic variant which is regarded as identical. A homonym that has been validated earlier is an *earlier homonym*; while one validated later is a *later homonym*. When the same name or its orthographic variant has been simultaneously applied to more than one taxonomic group, each valid publication of the name constitutes a *simultaneous homonym*.

*Note 2.*—In the case of epithets denoting subdivisions of a family, a genus, or of a species, *formal homonymy* occurs if two identical combinations are obtained by connecting the epithets concerned *directly* with the names of their respective major groups (*i.e.* family, genus, or species).

Art. 61B: Later homonyms, and such simultaneous homonyms as have been correctly discarded under Art. 61A are *impriorable*, typonymous formal homonyms representing subdivisions of unequal rank of a family, genus or a species being excepted (Art. 28B): typonymous formal homonyms of unequal rank and other valid names that are not covered by the first part of this rule are *priorable*.

In special cases, the Congress is empowered to make names *impriorable* under certain circumstances (*see* Arts. 21A–D, 62A, & 63A).

*Note 1.*—When a real (not formal) homonym is typonymous with an earlier homonym, it is permissible to consider the former as either distinct from, or identical with, the latter (*see* also Arts. 46 & 47); but neither treatment makes the later homonym *priorable*.

*Note 2.*—A name is called *priorable* when it must be included in priority considerations; or *impriorable*, when it must not be included in priority considerations. *Impriorable* names and combinations cannot be legitimized, but they can be used as basynyms for making new *priorable* isonyms. (*cf.* Art. 53A Note 1 and 56A).

[The reason why later homonyms and such simultaneous homonyms as are rejectable under Art. 61A should be made *impriorable* is that their use “may cause error or ambiguity” (Art. 4). Since it is permissible to simplify more complicated names of the subdivisions of a family, genus or species (*see* also Arts. 26A & 28A–B), the use of the same epithet for

two or more subdivisions of different rank having different types would, when simplified, produce formal homonymy and cause error or ambiguity: Hence the necessity of making impriorable all non-typonymous formal homonyms. But no ambiguity or error would result in the case of typonymous formal homonyms, for they would all represent a taxonomic group having the same type: hence the priorability of typonymous formal homonyms. See also Introductory Remarks, Sect. 4 & 6].

ADD: Examples from Arts. 30 & 61.

Art. 62A: REVISE as follows:

A name of a taxonomic group whose type is not extant, or if extant is inadequate for any decisive interpretation, must not be used in priority considerations or legitimized if, owing to its use with different meanings, it has become a permanent source of confusion or error. A list of names to be abandoned for this reason (*Nomina ambigua*) will form Appendix IV.

[In view of the wording of the 1905-1910 Rules and the opinions expressed by competent nomenclaturists at the Amsterdam Botanical Congress (1935) it appears that this rule was originally intended by the legislators to cover only those names which, owing to the absence or the imperfection of types, did not admit of a definite interpretation. The example in the old Rules reads thus:

“Linné a décrit sous le nom de *Rosa villosa* une plante qui a été rapportée à plusieurs espèces différentes et dont l'interprétation certaine paraît impossible; pour éviter la confusion qui résulte de l'emploi du nom *Rosa villosa*, il est préférable dans ce cas, comme dans d'autres analogues, d'abandonner complètement ce nom.”

In the 1935 Rules, the discussion of this example has been abbreviated. This abbreviation coupled with the lack of a definition of the word “permanent” as used in the rule itself, has been responsible for interpretations which were not foreseen when Art. 62 was revised in 1930. The new interpretations contradict the type principle, which obliges botanists to disregard all interpretations of a taxonomic group that do not include the type. See also the Introductory Remarks, Sect. 11].

Art. 62A: DELETE the example concerning *Alsine* L.

[In view of the official typification of the genus on *A. media* L.—the correct lectotype for the genus (see also SPRAGUE in Kew Bull. 1920 p. 308)—the misinterpretations cannot be said to be permanent. Under Art. 56A, *Alsine* L. (1753) becomes a synonym of *Stellaria* L. (1753), VILLARS (Hist. Pl. Dauph., 1789) being the first person to choose between these two synonymous names of equal age].

ADD: Note 1.—A *nomen confusum* is a special instance of a *nomen ambiguum* whose description, being based on a type composed of two or more discordant elements pertaining to different species, genera or orders, was supposed to be of the same species or even of the same individual, and is moreover incapable of

a certain typification. A list of names to be abandoned for this reason will form Appendix V. (*see also* Art. 21B-6).

Examples as in Art. 61.

*Note 2.*—A *nomen monstrositatis* is another special case of a *nomen ambiguum* whose description, being based on a monstrosity, cannot give any certain clue to the identity of the taxonomic group to which the monstrous type specimen belongs. A list of names to be abandoned for this reason will form Appendix V *bis*.

Examples as in Art. 65.

[It is difficult to give a definition of a monstrosity that would be acceptable to all systematists. Opinions would differ whether a specific name based on a specimen which had produced either hexamerous flowers instead of the normally pentamerous ones, or entire leaves instead of the usually divided ones, should be included under the category of *nomina monstrositatum*. It is therefore desirable to enumerate in a list all the names to be rejected under this part of the provision].

*Note 3.*—If a *nomen confusum* or *nomen monstrositatis* has, subsequently to its publication, been typified on any one part of the original specimens and the error excluded, and moreover, if the new typification is accompanied by an amended description and by a citation of one or more new specimens agreeing with the new typification, then the name becomes priorable from the latter date.

[*N.B.*—It may be useful to deny validity to *nomina ambigua*, *confusa*, vel *monstrositatum*. No useful purpose is served by allowing the names validity and, at the same time, by denying priorability. On the contrary, by denying the names a valid status, changes would be avoided in such homonyms as were published in accordance with the old Rules which regarded all kinds of *nomina ambigua* as invalid. (Cf. Art. 21B-b)].

Art. 63A: REVISE as follows:

A name of uncertain application (*nomen dubium*) must neither be included in priority considerations nor be legitimized until its application has been made quite precise on botanical grounds. (*see also* Art. 22B).

[The word *reject* has been used in different senses in Arts. 61-62, 64, 65, etc., so that to reject sometimes means also "to render impriorable". (cf. Art. 62, and also the current phrase: *nomina specifica rejicienda*). Hence the necessity of the paraphrase to make the rule quite unambiguous].

Art. 64 & 65: DELETE: Incorporated in Art. 62A Notes 1 & 2.

Art. 66: DELETE: Incorporated in Art. 50B.

Art. 67: DELETE: Incorporated in Art. 25A.

Art. 68: DELETE: Incorporated in Art. 27A.

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Art. 69: DELETE: It is a part of Arts. 53A-B & 56A.

Art. 70B: Epithets of species and of lower groups must be written with a small initial.

[The Recommendation for capitalizing specific epithets in certain cases causes a good deal of trouble and is based on the false assumption that pre-Linnean generic names have a status under the Rules. In many parts of the world, foresters and economic botanists decapitalize specific epithets; so do also the majority of American systematists and all zoologists. No useful purpose is served by maintaining this Recommendation].

Art. 70c: Names or epithets of taxonomic groups higher than species are written with an initial capital letter.  
[Parts of Arts. 25 and 26].

Rec. XLIII: DELETE: Annulled by Art. 70B.

Section 14: READ: "Gender of names" instead of "gender of generic names".

Art. 72B: Epithets denoting either species or the subdivisions of a genus or species, when adjectival in form and not used as substantives agree in gender with the generic name.  
[Parts of Arts. 26, 27 and 28].





# THE GARDENS' BULLETIN STRAITS SETTLEMENTS

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## PALMÆ MALESICÆ

### VIII.--THE GENUS *LICUALA* IN THE MALAY PENINSULA

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#### 1. Introduction

The results embodied in this paper are of a study undertaken with the view of arranging systematically the Singapore herbarium specimens of the *Licuala* species indigenous in the Malay Peninsula. The present world conditions, entailing the cessation of intercourse with certain botanical institutions, the dislocation of the staff at some others, and the risks to parcels during transit across oceans have precluded my obtaining either critical notes of the type specimens preserved outside the Malay Peninsula, or a loan of the specimens themselves. Under such limitations the results of my undertaking would have been of little systematic value but for the valuable assistance derived from BECCARI'S monographic work on the genus published first in an abbreviated form in *Webbia* V, 1921, pp. 22-55, as a part of *Recensione delle Palme del Vecchio Mondo Appartenenti alla Tribù delle Corypheae* and then in an extended form in the *Annals of the Royal Botanic Gardens, Calcutta*, XIII, printed in 1931 and published in 1933 (cited

below as *Calcutta Annals* or *Cdlc. Annals* XIII, 1933). In this latter work BECCARI incorporated the results of the opportunities he had not only of consulting the type material of most of the species he studied and of comparing newer material with it, but also of making lengthy critical descriptions, analytical drawings and photographic plates of such specimens.

## 2. Hints to Collectors

*Licuala* is a genus of small palms the largest of which attain about 15-20 feet in height and a few ( $\pm 3$ ) inches in stem diameter. However, most of the species are almost stemless or only a few feet in height. Compared therefore with the long, thorny rattans or tall giants like *Corypha*, *Borassus* and *Oncosperma*, the *Licuala* species present very few obstacles to the collector making good herbarium specimens. The tallest ones can be cut down with an ordinary jungle knife within a few minutes, and the specimens of leaves and of spadices with flowers and fruits do not form very weighty or bulky specimens. Though the petioles of most species are provided with thorns, yet the specimens are easily handled even without leather gloves, which are required in handling specimens of Rattans or *Oncosperma*. Hence one would have expected this genus to be well represented in most herbaria, and also to be specifically well known in areas botanically fairly well explored. From the study of the species in the Singapore herbarium and from the notes given by BECCARI, I conclude that this is far from the case. This country has been explored botanically for the last fifty years or more by different botanical collectors and I find the *Licuala* species are very badly represented in the herbarium. Even in regions botanically well known, species formerly not recorded are being discovered. The principal reason for this is that in the field most of the species look alike and are not easily distinguished one from another except when the collector has made a special point to study them in the field. The number of segments present on a leaf often depends on the age of the plant and to a certain extent on the conditions under which it grows. Many times really acaulescent species may be mistaken for others which flower and fruit when quite small or stemless. In many species, moreover, the flowers and fruits remain hidden among the leaves so that they may be passed as the sterile stages of others.

If the collector is therefore to see that he does not miss any uncommon species he meets with in the jungle, he must learn to distinguish the species in the field. To

do this satisfactorily the following pointers may be useful:-

1. The average number of main nerves (costae) radiating from the apex of the petiole is a more stable character than the average number of leaflets into which a leaf is divided, though the latter is sometimes useful in the identification of a species.
2. Some species have always undivided leaves (not noticed in any species wild in the Peninsula).
3. In some species the median segment of the leaf is three or more times as broad as the other lobes, in others the segment is nearly as broad as the other segments.
  1. In some species the broad median segment is entire, in others it is divided half-way.
5. In some species the middle segment becomes distinctly petiolulate, in others it is always sessile.
6. In some species the lateral margins of the leaf segments are arcuately cuneate, in others the margins are straight.
7. Some species are always solitary, others form tufts.
8. Some are always stemless, others produce stems though they may begin to flower when stemless.
9. In some species the spadices reach high above the height of the leaves so as to become visible from a distance; in others the spadices remain hidden among the leaves.
10. In some species the spadices are simple, terminating with one or more floriferous branchlets (spikelets); in others the spadices are compound.
11. In some species the lower branches of the compound spadices are subdivided into 10 or more spreading spikelets; in some others the branches contain only 2-5, usually digitate, branchlets; in still others the branches are simple, undivided.
12. Different species are characterised by different colour of spadices, flowers and fruits.
13. In some the fruits are 3-4 times as long as they are thick; in others the fruits are globose.

In a given field, all Licualas may have many of the above-mentioned characters in common, but they will differ in others, which, though a few, will suffice to distinguish

between the species, even disregarding such variable characters as the height of the plant, and the nervation and the number of the leaf-segments. But it is desirable to record in the field notes as many particulars as possible concerning the habit, stem height (without leaves), etc., of the plants, size of the petioles, leaf-lamina and spadix, the average number of segments to a leaf, the average number of main branches to a spadix, the colour of fruits, flowers, etc.

For herbarium purposes the leaf specimens should be taken from flower-bearing crowns; and if there is some variation in size, etc., in the leaves of non-flowering crowns, some few specimens may be made to indicate this variation. Care, however, should be taken to use appropriate tags so that the leaves may be sorted and mounted in the herbarium according to their status without any fear of confusion (*vide* my remarks on numbering the specimens in the field in *Gard. Bull., Straits Settl.* IX, 1937 p. 155, 286-287, and 303 in example).

If it is desired to reduce the bulk of the specimens one may split the leaves longitudinally, taking care to leave the middle segment intact; the half without median segment becomes practically useless, unless the species is rare and a sufficient number of leaves is not available for making up the sets.

### 3. Subgenera and Sections

Apart from the collector's difficulties, the genus *Licuala* presents many difficulties to a systematist. There is a good deal of variation in the vegetative parts of the plants. Though the branching of the spadices frequently occurs in a definite manner and forms a useful character to differentiate between species, it is not one that can be employed to subdivide the genus into subgenera or sections; such a classification not only places very closely related species in different sections or subgenera, but also divides subgenerically or sectionally polymorphic specific units.

BECCARI, who in 1886 had relied on the branching of spadices to divide the genus *Licuala* subgenerically into EU-LICUALA (implicit), LICUALOPSIS, LICUACELIA and LICUALINA (*Malesia* III, 1886, pp. 69-90), was obliged in 1921 to reduce these subdivisions to two, namely, EU-LICUALA and LICUACELIA, the latter to include LICUALOPSIS and LICUALINA (*Webbia*, V, 1921, pp. 22-55). Here BECCARI made also a new subgenus DAMMERA, but the main character used to define this subgenus is derived from the flower. This disposition has also been adopted in BECCARI's monograph published in the *Calcutta Annals*, XIII (1933). Leaving the subgenus DAMMERA out of consideration for

the present, this modified subgeneric division of *Licuala* is still unsatisfactory, because the basis used to distinguish these two subgenera is still the character of the branching of the spadices. Under such a classification, for instance, *L. tanuginosa* and *L. Kingiana* fall into two subgenera, when the species are so very closely related that they may be regarded as two varieties of the same species. Further, this classification obliges one to split such variable species as *L. modesta* Becc. *sensu lato* into *L. modesta* Becc. *sensu stricto* and *L. Wrayi* Becc. according to the development of the spadix, and then to place these two species thus defined into two different subgenera.

The other grouping of the *Licuala* species is one published by DRUDE (ENGL. u. PRANTL. *Pflanzenf.* II, 3, 1887, p. 35), subsequently modified by RIDLEY. DRUDE was apparently unaware of the subgenera published by BECCARI, for, without making any reference to the latter's subgenera, DRUDE proposed independently two subgenera, namely: EU-LICUALA to include the species with a dorsal embryo, and PERICYCLA (Bl.) Drude (spelt by error *Pericycla*) to include the species with a basilar embryo. The type of this second subgenus was *L. penduliflora* (Bl.) Miq., published previously as *Pericycla penduliflora* Bl. It is apparent that, in reducing *Pericycla* Bl. to a subgenus of *Licuala*, DRUDE relied on the characters mentioned by BLUME, who had examined the position of the embryo in the flower only, where the position is often misleading. I point this out because I have not seen any species of *Licuala* having a basilar embryo, and BECCARI, who had opportunities to examine a very large collection of fruiting specimens, does not mention any such species.

In 1903 RIDLEY reduced *Pericycla* Bl. to a section of *Licuala*, defining it to include all species having a "panicled inflorescence" (*Journ. Roy. Asiat. Soc., Straits Settl.*, 41, 1903, p. 42). The section was naturally typified on *L. penduliflora*, of New Guinea, for which RIDLEY adopted the name *L. pericycla* Zipp. Mss.; but the only Malayan species that RIDLEY included in the section was *L. paniculata* Ridl., though *L. longipes*, *L. paludosa*, etc. have inflorescences similarly branched. RIDLEY adopted this section also in his later works, viz.: the *Materials for a Flora of the Malay Peninsula, Monocotyledons* (cited below as *Materials* or *Mat.*), II, 1907, pp. 159-165, and the *Flora of the Malay Peninsula* (cited below as *Flora*), V, 1925, pp. 24-30. But if, following RIDLEY's definition, one were to place all the species having "panicled inflorescences" in the section PERICYCLA, the group would consist of utterly unrelated species, several closely related species remaining outside.

In view of these drawbacks of previous definitions, an inquiry was made into the problem of subdividing the genus. The most stable characters were found to lie in the flowers, the nature of the divisions of the androecium affording characters to group the species into well defined subgenera. The utility of these characters was recognized by BECCARI (op. cit 1921 & 1933); but he employed them only in the analytical keys provided for the identification of the species, and not to define his subgenera. On the basis of these characters, I divide the genus *Licuala* into three subgenera, namely: **LIBERICULA** (new), **EU-LICUALA** and **PERICYCLA**. The second is further divided into four sections, but **LICUACELLA** is not retained.

**I. LIBERICULA. Furtado subgen. nov.**

Staminum filamenta 6 erecta aequalia, basi lata superne subulata, ad basin libera vel fere, nec in annulum prominentem ad corollæ faucem connata. Flores inter majores, circa 15 mm. longi, 5 mm. crassi.

Species unica, *L. peltata* Roxb., in regionibus humidis inter septentriones et orientem Indiarum spectantibus ex Assam, Khasia, Sikkim, etc. ad meridiem in Insulis Andamanicis, Tenasserim, et Thailandia (Siam) meridionali habitat.

**II. EU-LICUALA** Drude in Engl. u. Prantl, Pflanzenf. II, 3 (1887) 35; Ridl., Flora V (1925) 24 loco sectionis, nom. nud.

*Licualopsis* Becc., Malesia III (1886) 85.

*Licualina* Becc. op cit p. 88.

*Licuacella* Becc. op cit p. 86, in Webbia V (1921), 21 et 37, in Calc. Annals XIII (1933), 116 et 128. Syn nov.

Staminum filamenta 6, aequalia, erecta vel inflexa, ad corollæ faucem in annulum prominentem connata. Flores 3-8 mm. longi, 2 mm. crassi.

**Sectio 1: WURMBIA Furtado sect. nov.**

Annulus staminalis membranaceus, aut truncatus, apice in filamenta parva, erecta, filiformia productus, aut in filamenta erecta, lobiformia, abrupte subulata divisus. Antheræ haud aristatæ.

Inter divisiones *Licualae* hæc sectio species plurimas includens, qui in regionibus torridis et semitorridis ex Birmania, Thailandia (Siam) et China meridionale ad Celebesiam et Novam Guineam habitant, maximæ species in regionibus malayanis (viz. in Peninsula Malayana, Sumatra et Borneo).

Species typica: *L. spinosa* Wurmbr.

Nomen hujus sectionis in honorem cl. F. VON WURMB, auctoris speciei typicæ.

**Sectio 2: BONIA Furtado sect. nov.**

Annulus staminalis brevis, crassus. Filamenta erectiuscula, lobiformia, elongata, subbulbosa, apicem in connectivum discoideum antherarum dorso adnatum, expansa. Antheræ haud aristatæ.

Species hujus sectionis adhuc unica (*L. fatua* Becc.) cognita, habitat in Indo-China. Nomen hujus sectionis in honorem Rev. Presb. BON, qui specimen typicum speciei in Tonkinia Occidentale legit.

**Sectio 3: DAMMERA** (Becc.) Furtado stat. nov.

*Dammara* Becc. in Webbia V (1921), 21 et 38 et in Calc. Annals XIII (1933) 116 et 130 (loco subgeneris).

*Dammara* K. Schum. et Laut, Fl. deutsch Schutzgeb. Sudsee (1900) 201 t. A-F et 2 (loco generis).

Annulus staminalis elevatus, crassus. Filamenta e basi valida superne attenuata et antherarum dorso prolixè adnata. Antheræ haud aristatæ. Species hujus sectionis duæ tantum cognitæ, ambæ in Nova Guinea habitant.

Species typica: **L. Beccariana** Furtado nom. nov.

Basynym: *L. ramosa* (K. Schum. et Laut)

Becc. (1921), nec *L. ramosa* Bl.

**Sectio 4: BECCARIA** Furtado sect. nov.

Annulus staminalis brevis, crassus, conspicuus. Filamenta lobiformia, perlonga, subulata, apice bis inflexa (i.e. apice introflexa et rursus erecta), antheras apiculato-aristatos ferentia.

Species hujus sectionis adhuc unica (*L. reptans* Becc.) cognita in Borneo habitat.

Nomen hujus sectionis in honorem Cl. O. BECCARI, palmographi magni.

### III. PERICYCLA (Bl) Drude in Engl. u. Prantl, Pflanzenf. II, 3 (1887) 35 (Sphalmate Pericyla).

*Pericycla* Bl., Rumphia II (1844) 47 t. 94 (loco generis).

*Pericycla* (Bl.) Ridl. in Journ. Roy. Asiat. Soc., Straits Settl. 41 (1903) 42, Mat. II (1907) 159 et Flora V (1925) 25—(loco sectionis; sphalmate *Pericyclus*).

Staminum filamenta 6, erecta, valde inæqualia, 3 ad loborum apicum majorum inserta, et 3 in sinus vel ad loborum apicum minorum sita, ad corollæ faucem in anulum prominentem connata. Antheræ haud aristatæ. Flores inter minores.

Species hujus subgeneris paucae, omnes in regionibus oceanii habitant; unica in Australia, alteræ in insulis

papuancsianis usque ad insulas Solomonenses, maxima in Nova Guinea.

Species typica: *L. penduliflora* (Bl.) Muq. ( *Periclycla penduliflora* Bl.).

#### 4. Analytical Key to the Species

- A. Flowers about 15 mm. or more long and 5 mm. or more across. Stamens 6, equal, free at the throat of the corolla, the staminal ring being almost obsolete (LIBERICULA). .. *L. peltata* Roxb.
- AA. Flowers about 3-8 mm. long and 2 mm. across. Stamens united at base into a conspicuous ring at the throat of the corolla .. (B).
- B. Staminal ring 3-lobed, lobes emarginate; 1 filament in the notch at the apex of each lobe and 1 in each sinus between the lobes. (PERICYCLA).
- (a) Leaf-blade entire. Partial inflorescences paniculately divided into 8-10 branchlets (spikelets) .. *L. grandis* Wendl. (cultivated).
- (aa) Leaf-blade multipar-tite. Partial inflorescences digi-tately divided into 3-4 branchlets .. *L. Rumphii* Bl. (cultivated).
- BB. Staminal annulus ends in 6 almost equal lobes or filaments (EU-LICUALA) .. (1).
- 1A. Spadix simple, terminated by one or more floriferous spikelets .. (2).
- 1B. Spadix branched into two or more partial inflorescences, each internode sheathed by a separate spathe .. (4).
- 2A. Spadix terminated by one or two spikelets .. (3).

- 2B. Spadix terminated by many  
floriferous spikelets (some-  
times a short liguliform  
spathe intervening) . . . *L. modesta* Becc.  
(partly).
- 3A. Spadix axis and flower-buds  
covered with long coarse  
hairs. Calyx striate, split-  
ting into many longitudinal  
fibres. Leaf divided into  
5-8 segments . . . *L. Kingiana* Becc.
- 3B. Spadix axis and flower-buds  
covered with minute hairs,  
Calyx membranous, not  
dissolving into fibres. Leaf  
segments 12-15 . . . *L. Scortechinii* Becc.
- 1A. Partial inflorescences un-  
branched (*i.e.* consisting of  
solitary spikelets) . . . (5).
- 1B. Partial inflorescences  
branched . . . (14).
- 5A. Flowers distinctly pedicelled.  
Calyx turbinate or nar-  
rowed into a long pedicelli-  
form base . . . (6).
- 5B. Flowers not distinctly  
pedicelled. Calyx cylin-  
drical or campanulate . . . (8).
- 6A. Spikelets distinctly hairy.  
Calyx hairy, or, if  
deciduously hairy, the  
corolla is distinctly hairy . . . (7),
- 6B. Spikelets and calyx not hairy,  
but covered with fugaceous  
rusty-brown scales. Corolla  
glabrous . . . *L. Moyscyyi* Furtado
- 7A. Hairs on spikelets and calyx  
long, coarse. Calyx nearly  
as broad as long, membran-  
ous, striate, turbinato-  
campanulate, suddenly  
ending in a short solid  
cylindrical base, more or  
less lobed at apex. Flowers  
usually solitary . . . *L. Kunstleri* Becc.
- 7B. Hairs on spikelets and calyx  
fine. Calyx coriaceous, not  
striate, cup-shaped, nar-

- rowed into a long (longer than the cup) pedicelliform base, obscurely denticulate at apex but not lobed or lacerate. Flowers in groups of 2-3 in some parts
- 8A. Calyx cyathiform-campanulate, deeply lobed . . . *L. Commersoni* Furtado (9).
- 8B. Calyx cylindrical, truncate or lobed at apex . . . (11).
- 9A. Calyx covered with long coarse hairs, usually one carpel fertile. The lateral margins of leaflets nearly straight . . . (10).
- 9B. Calyx covered with fine hairs which later fall off partly. Frequently two or three carpels fertile. Lateral margins of leaflets arched, so that leaflets are arcuately cuneate . . . *L. kemamanensis* Furtado.
- 10A. Hairs tawny . . . *L. acutifida* Mart. (partly).
- 10B. Hairs whitish . . . *L. pusilla* Becc. (partly).
- 11A. Calyx  $\pm 4$  mm. long, densely tomentose, curvately cuneate at base, little lobed at apex . . . *L. tiomanensis* Furtado.
- 11B. Calyx smaller, puberulous or glabrous, not curvately cuneate at base; truncate or deeply lobed at apex . . . (12).
- 12A. Calyx conspicuously striate, glabrous, asymmetrically lobed at apex, truncate, caudiculate at base . . . *L. pahangensis* Furtado.
- 12B. Calyx puberulous or glabrous, but neither conspicuously striate nor caudiculate . . . (13).
- 13A. Calyx apex almost truncate at first, then irregularly split . . . *L. Ridleyana* Becc.
- 13B. Calyx deeply lobed . . . *L. confusa* Furtado.

- 11A. Lower partial inflorescences paniculiform, composed of 10 or more scattered spikelets ( floriferous branchlets) . . . (15).
- 11B. Lower partial inflorescences composed of 2-5, usually digitate, spikelets . . . (17).
- 15A. Spikelets slender, somewhat flexuose. Flowers frequently in groups of 2, spirally, or in terminal parts subalternately, arranged. Calyx 5 mm. long, about twice as long as it is broad . . . *L. longicalycota* Furtado.
- 15B. Spikelets stouter, not flexuose. Flowers pluriseriate, usually solitary. Calyx shorter, almost as long as broad . . . (16).
- 16A. The spathes much inflated. Spadix flexuose. Calyx cylindrical, thick from the very beginning. Ovary villous in the upper part . . . *L. longipes* Griff.
- 16B. Spathes not so inflated. Spadix not flexuose. Calyx campanulate, membranous at first. Ovary glabrous . . . *L. paludosa* Griff.
- 17A. Calyx glabrous, not split or lobate, but denticulate at apex . . . (18).
- 17B. Calyx otherwise . . . (19).
- 18A. Leaf-lamina about 12"-16" in radius, divided into 12 or more, triangular, subequal segments . . . *L. glabra*
- 18B. Leaf-lamina 8"-12" in radius, divided into 5-8, arcuately cuneate, unequal segments, median segment divided half-way . . . *L. glabra* var. *selangorensis*.
- 19A. Flowers pedicellate . . . *L. mirabilis*.
- 19B. Flowers not pedicellate . . . (20).

- 20A. Spathes and spadix densely covered with dark fuscous ferruginous scurf, and the spikelets and calyces densely covered with similarly coloured hairs .. *L. ferruginea.*
- 20B. Scurf and hairs when present not similarly coloured and frequently not so thick .. (21).
- 21A. Calyx cylindric, truncate at first, slightly split later. Spadix and spikelets not covered with a thick coat of deciduous tomentum .. *L. malajana* Bocc.
- 21B. Calyx campanulate, lobed, or, if apparently truncate in early phases, the spadix and spikelets covered with a thick coat of deciduous tomentum .. .. (22).
- 22A. Plants stemless, about 12"-18" long, smallest in the genus. Leaves the smallest in the genus, divided into 3-8, rarely more, segments. Spadix about 12"-15" long, with spikelets 11½"-21½" long .. (23).
- 22B. Plants and leaves larger, with more leaf segments. Spadix and spikelets usually longer .. .. (24).
- 23A. Flowers frequently in groups of 2-3, often more than one fertile carpel. Fruit narrow elongate, about 3-4 times as long as it is thick. Ovary glabrous. Median leaf-segment never petiolulate .. .. *L. Kiahii* Furtado.
- 23B. Flowers solitary, with only one fertile carpel. Fruit globose. Ovary hairy. Median segment frequently petiolulate .. .. *L. triphylla* Griff.

- 21A. Lower partial inflorescences usually bifid, the upper ones unbranched. Most of the leaflets nearly linear, about  $3\frac{1}{4}$ "– $1\frac{1}{2}$  inches in width (25).
- 21B. Lower partial inflorescences usually 3–5-branched. Leaflets in most cases broader and conspicuously triangular .. (26).
- 25A. Spikelets and calyces rusty-tomentose. Flowers pluriserial on a cylindrical spikelet .. .. *L. acutifida* Mart. (partly).
- 25B. Spikelets and calyces whitish-tomentose. Flowers arranged spirally on flexuose spikelets .. .. *L. pusilla* Becc. (partly).
- 26A. Spadix, spathes and spikelets covered in early stages with a thick coat of creamish deciduous woolly tomentum. Corolla densely sericeous. Flowers solitary *L. lanuginosa* Ridl.
- 26B. Tomentum, when present on spadix, spathes or spikelets, not thick, and minute. Flowers frequently in groups of 2–3, Corolla glabrous or minutely hairy (27).
- 27A. Leaflets about 12" long. Spadix at the most  $2\frac{1}{2}$  ft. long. Spikelets usually less than 6" long and the lower spadix branches about 6" or less apart. Fruit elliptic, about 10–13 mm. long, 6–8 mm. through .. *L. modesta* Becc. (partly).
- 27B. Leaflets 20" or more long. Spadix 6 ft. or more long, with lower branches 9–18 inches apart, each spikelet in lower branches being 9–15" long. Fruit globose, 6–8 mm. in diameter .. *L. spinosa* Wurm.

## 5. Systematic Notes

A. **LIBERICULA** Furtado.

**Licuala peltata** Roxb., Fl. Ind. II (1821) 179; Griff. in Calc. Journ. Nat. Hist. V (1815) 321, et Palms Brit. Ind. (1850) 120 t. 222; Hook. f., Fl. Brit. Ind. VI (1892) 430; Becc. in Webbia V (1921) 24 et 39, et in Calc. Annals XIII (1933) 131 t. 71.

**MALAY PENINSULA:** *Lower Siam*, Kantang (Handl. & Nur, 4720).

*Distribution:* In the monsoon forests of North East India, Burma, Andamans and Nicobars.

This species was not recorded previously in the Peninsula, where it occurs only in the northern-most parts which form the southern-most range of the distribution of the species. In cultivation it is grown in many gardens throughout the Peninsula. The species sometimes begins to flower before its leaves have started to divide into segments.

B. **EU-LICUALA** § *Wurmbia* Furtado.

1. **Licuala acutifida** Mart., Hist. Nat. Palm. III, ed. 1 (1842) 237, t. 135 III et IV; Griff. in Calc. Journ. Nat. Hist. V (1815) 237 et Palms Brit. Ind. (1850) 122 t. 222 A et B; Mart. op. cit. III, ed. 2 (1849) 236 et (1850) 318; Hook. f., Fl. Brit. Ind. VI (1892) 433; Ridl., Mat. II (1907) 163 pp.; Becc. in Webbia V (1921) 30 et 11; Ridl., Flora V (1925) 27 pp.; Becc. in Calc. Annals XIII (1933) 168.

**MALAY PENINSULA:** *Penang*, Tulloh Bahang (Curtis, 1010); Government Hill (Ridley and Curtis, 7906); Waterfall (Curtis in June 1890); Penang Hill (Ridley in July 1898).

This species is very near to *L. Kunstleri* and so far not known from outside Penang. RIDLEY referred here some specimens of *L. pusilla* Becc. LOBB 280 cited by BECCARI as from Singapore may have come from Penang, for LOBB frequently gave incorrect localities to his plants, and there are reasons to believe that the majority of the Malayan plants collected by LOBB were from Penang (*vide*, BURKILL, in *Gard. Bull. Straits Settl.* IV, 1927 p. 127).

CURTIS notes on his specimen numbered 1010 that this is not the palm that supplies the walking sticks known as the "Penang Lawyer".

2. **Licuala confusa** Furtado sp. nov. Fig. 1.

? *L. acutifida* Becc. var. *peninsularis* Becc. in Webbia V (1921) 30 et 44, et in Calc. Annals XIII (1933) 169 t. 10-II. *Syn. nov.*?

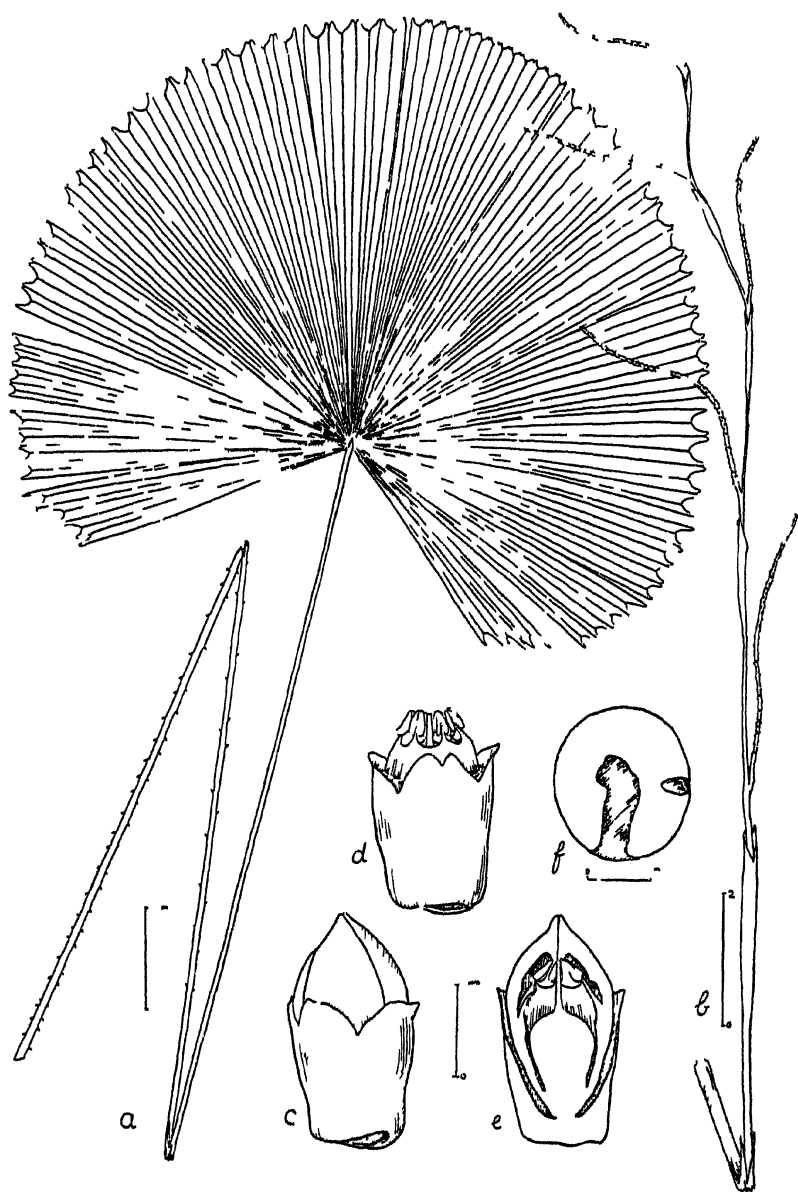


Fig. 1 *Licuala confusa* (Holotypus FURTADO no A)

a. Frons b Spadix c Alabastrum d. Alabastrum, petala resecta, ut aestivatio staminum appareat e. Alabastrum verticaliter discissum f Semen verticaliter discissum

A *L. Ridleyana*, cui valde affinis, differt et auct. conspicue lobato, apice nonnihil membranaceo.

*Palma* solitaria, acaulescens. *Petiolus* ultra 1 m. longus, interdum minor, ad medium aculeatus. *Segmenta* foliorum circa 17, subaequalia vel inaequalia, 2-4 costata, 34-45 cm. longa; medianum indivisum, interdum alteri multo latius, 6-12 costatum. *Spadix* petiolo brevior, in 1-5 partiales inflorescentias simplices, axi tomentosae divisus. *Flores* pluriseriatim dispositi. solitarii, plerumque super pulvinos prominulos interdum in depressionibus inserti. *Calyx* puberulus, cylindricus, basi truncatus, apice 3-lobatus, lobis rotundatis, saepe in 2 lobulos fissis, parum striatis, nonnihil membranaceis. *Corollae* calyce duplo longior, lobis acutis, puberulis vel non. *Annulus* staminalis in 6 filamenta antherifera abrupte subulata divisus. *Ovarium* glabrum. *Fructus* vivo rubrus, in sicco brunnescent, rugosus, circa 8 mm. in diam.; semen orbiculare 5 mm. in diam., gramineum, fossa integumentale cylindrica, ad centrum seminis cursa, apice parum curvata.

MALAY PENINSULA: *Perak*, Tapah Hill (Furtado sub litt. A, 11 June 1937-Holotypus); Tapah (Ridley, 14112); Bujong Malacca (Curtis in Dec. 1895 et in Aug. 1898). *Dindings*, Lumut (Ridley in Feb. 1892). *Selangor* Semenyih (Hume, 7962).

RIDLEY 14112 is the haptoholotype of *L. Ridleyana* and in the capsules mounted on the sheet there are a few flowers which agree with the description and figure given by BECCARI for that species. But the vast majority of the flowers in the capsule and the flowers still attached to the spikelets are like the ones described here. Since I have typified *L. Ridleyana* on the characters of the flowers, I could not retain under that species RIDLEY 14112 from the Singapore herbarium. There are some minor variations between RIDLEY 14112 and the holotype of *L. confusa*. The Dindings specimens has no flowers and has been cited here because of its general resemblance to this species.

I have reduced here *L. acutifida* var. *peninsularis* with some doubt. RIDLEY 9806 is cited as a paratype of the variety, but its duplicate in Singapore is *L. Ridleyana* as typified here. I have not been able to find in the Singapore herbarium any material which agrees exactly with the figures by BECCARI. RIDLEY 10329 from Lumut (the type collection is cited as 10239) bears calyces somewhat similar to the ones figured by BECCARI, but the partial inflorescences are branched in the Singapore specimen and the corolla is hairy. It seems to represent a variety of *L. spinosa*, typical material of which species is also mounted on the same sheet.

*L. confusa* has manifest affinities with *L. Radleyana* but this has a truncate calyx which later splits irregularly. *L. pahangensis*, also an ally of *L. confusa*, has a glabrous, conspicuously striate calyx which bears a somewhat caudiculate base and less symmetrical lobes at the apex.

3. *Licuala Corneri* Furtado sp. nov. Fig. 2.

*L. Kunstleri* proxima, a qua calycibus basin versus pedicelliformiter longe productis truncatis, obscure denticulatis, sat distincta.

*Palma* solitaria ut videtur, cum caule 0.60–2 m. longo, 2–4 m. alta. *Petiolus* 35–100 cm. longus, prope basin tantum aculeatus, in medio circa 6–8 mm. et apice 4 mm. latus. *Segmenta* frondium subaequalia, circa 12–14, cuneatissima, 2–3, raro 1–1, costata, 25–35 cm. longa, apice 3–15 cm. lata; mediana alteris latiora, apice dentibus brevissimis. *Spadices* compositi, 35–80 cm. longi, in dimidia parte basali haud ramosi, cum 2–3 spathis involuti, in altera parte terminali in ramos simplices, florigeros, plerumque 3–4, ad 15 cm. usque longos, dense pubescentes, divisi. *Spathae* basales bicarinatae, alterae tubulares. punctis fugaceo fusco-leprosis tectae, apice marcescentes. *Flores* geminati vel interdum solitarii, pedicellati, in alabastro fusiformes, 5–8 mm. longi. *Calyx* dense pilosus, 1 mm. longus, apice truncatus, obscure 3-denticulatus, in basin pedicelliformiter contractus. *Corolla* calyce cupulari duplo longior, glabra. *Annulus* staminalis in filamenta 6 apice abrupte contracta, divisus. *Fructus* immaturus tantum visus, ellipticus, utrinque acutus, circa 6 mm. longus. 1.5 mm. in diam., fossa albuminali indivisa, cylindrica.

MALAY PENINSULA: *Kemaman*, Ulu Bendong in Kajang, alt. 500 ped. (Corner, 30072–Holotypus); *Sungai Nipa* (Corner, s.n.).

CORNER 30072 was found mixed with some specimens of *L. malajana*. The collector notes: palm is slender solitary; leaflets dark green above, pale beneath, not glaucous; flowers greenish white; fruit fall orange-red when ripe; perianth green; staminal tube white; ovary pale orange; inflorescence hanging".

Though this species falls into the group having simple partial inflorescences, it has no close ally in the Peninsula except the one described here as *L. Moyseyi*. In the long pedicelliform base of the calyx and its obscurely toothed apex the species may seem to appear very near to *L. Beccariana* of New Guinea but that species has been described to have very much longer flowers borne on simple and shorter spadices and belongs to the section DAMMERA.

4. *Licuala ferruginea* Becc. in Hook. f., Fl. Brit. Ind. VI (1892) 432; Ridl., Mat. II (1907) 162; Becc.

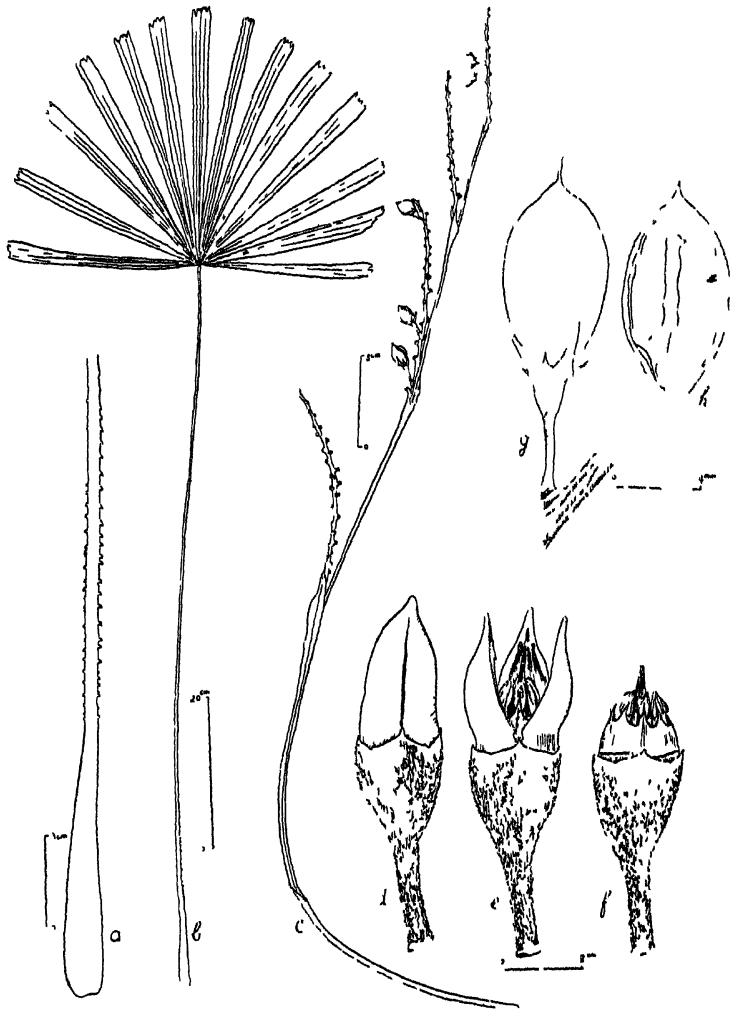


Fig. 2. *Licuala Corneri* (Holotypus: CORNER 30072).

a. Petioli pars inferior. b. Frondis lamina cum petiolo. c. Spadix fructiferus minimus. d. Alabastrum. e. Flos ad anthesin. f. Flos, corolla resecta, ut aestivatio staminum appareat. g. Fructus cum perianthio et filamentis staminum. h. Fructus verticaliter discissus, semen cum substantia integumentale oblique percurrente et embryone dorsale exhibens.

in *Webbia* V (1921) 32 et 16; Ridl., *Flora* V (1925) 26; Becc. in *Calc. Annals* XIII (1933) 180 tt. 9-X, 89 et 89 bis.

**MALAY PENINSULA:** *Kemaman* Bukit Kajang, alt. 1,000 ft. (Corner, 30398). *Pahang*, Pulau Tawar (Ridley in 1891); Bukit Sagu (Nur, 25167). *Negeri Sembilan*, Ayer Kuning near Bahau (Symington, 21380). *Johore*, Sednah (Ridley, 13519); Sungai Kayu Ara (Corner, 28688); Mount Austen (Ridley in Jan. 1901); Kluang (Holtum, 9260); Gunong Belumut (Holtum, 10605); Sungai Endau (Holtum, 21911). *Singapore*, Reservoir Woods (Ridley in 1893); Bukit Timah (Ridley, 3512); Sungai Jurong (Mat in 1891); Ang Mo Kio (Ridley, 6676); Bukit Mandai (Ridley s.n.); Bukit Arang (Goodenough on 16 Nov. 1889); Botanic Gardens' Jungle (Ridley, 3168).

*Distribution:* Sumatra and Riow Archipelago.

From all the peninsular species having branched partial inflorescences this species is easily distinguished by the presence of the ferrugineous tomentum on spikelets and calyx and by the sessile flowers. It is distinguished from the Sumatran *L. ferruginoides* (which frequently produces branched partial inflorescences) by longer hairs on the calyx and smaller flowers.

5. *Licuala glabra* Griff. in *Calc. Journ. Nat. Hist.* V (1845) 329 et *Palms Brit. Ind.* (1850) 124 t. 233; Hook. f., *Fl. Brit. Ind.* VI (1892) 432; Ridl., *Mat.* II (1907) 161; Becc. in *Webbia* V (1921) 34 et 48; Ridl., *Flora* V (1925) 26; Becc. in *Calc. Annals* XIII (1933) 192 tt. 14-I fig. 1-3, et t. 82.

*L. longepedunculata* Ridl. in *Journ. Roy. Asiat. Soc. Straits Br.* XLI (1903) 42, *Mat.* II (1907) 161 et *Flora* V (1925) 26.

**MALAY PENINSULA:** *Peninsular Siam*, Kampong Bukit (Kiah, 21256). *Kelantan*, Kuala Betis (Henderson, 29725). *Perak*, Gunong Batu Puteh (Wray, 254—Syntype of *L. longepedunculata*). *Pahang*, Karak (Best, 13884); Gunong Tahan (Haniff & Nur, 8111); Fraser Hill (Burkill & Holtum, 7842); Tahan Woods (Ridley, in 1891). *Malacca*, Gunong Ledang (Ridley, 3473); Mount Ophir (Feilding in 1892; Derry, 633; Hullett, 852; Ridley in Dec. 1899). *Selangor*, Bukit Hitam (Kelsall in 1890; Ridley in May 1896); Bukit Kutu (Ridley 7894).

In this species there is a good deal of variation in size and robustness of the leaves, spadices, and flowers, and I agree with BECCARI in reducing *L. longepedunculata* to *L. glabra*, though the former has somewhat larger flowers than

the type of the latter. The specimen from Peninsular Siam has a somewhat pedicelliform base to the calyx, but transitions from this to the typical form are also found.

6. *Licuala glabra* Griff. var. *selangorensis* Becc. in Webbia V (1921) 35 et 18; Ridl., Flora V (1925) 26; Becc. in Calc. Annals XIII (1933) 191 et 14-1.

MALAY PENINSULA: *Trengganu*, Gunong Padang alt. circ. 2,500 ft. (Moysey & Kiah, 33399). *Pahang*, Fraser Hill, alt. 4,000-4,300 ft. (Burkill & Holttum, 8126). *Selangor*, Semangkok Pass, up to alt. circ. 3,000 ft. (Ridley in Aug. 1904; 15881, et 12117: Haptoholotype); Sempang (Ridley in April 1911). *Johore*, Kluang (Holttum, 10601).

The Trengganu specimen cited above is a more robust form than the others.

7. *Licuala kemamanensis* Furtado sp. nov. Fig. 3.

A L. ferruginoidea, cui peraffinis, palma acaulescens, frondibus minoribus, spadicebus haud flexuosis, ramis supra spathae apicem remote orientibus, floribus minoribus, bracteolis inconspicuis recedit. Facie L. Kunstleri similis, sed floribus haud conspicue pedicellati, calyce basin versus haud valde angustato, ovaris pilosis, foliis minoribus dissimilis.

*Palma* humilis, acaulescens. Petiolus circa 30-65 cm. longus in specimina visa, tertia parte basali aculeis remotis brevibus, 1-2.5 mm. longis armatus. Segmenta foliorum circa 14, cuneatissima, 2-6 costata, subaequalia; medianum circa 27 cm. longum, 4 cm. latum, 3-6 costatum, apice obsolete dentatum costis approximatis; intermedia mediano aequilata vel fere, paulo breviora, oblique crosso-dentata, costis 3-4 nonnihil remotis; basilaria minima, 2-3 costata, 12-14 cm. longa, 2.5-3 cm. lata, apice intermediis conformia. Spadix unicus tantum visus, haud flexuosus, 60 cm. longus, in inflorescentias partiales duas simplices, 5-8 cm. longas, ferrugineo tomentosas, supra spathae apicem remoto orientes divisus, basi cum spathis 3 involutus. Spathae fugaceo fusco-furfuraceae, tubulosae, infima bicarinata. Flores pluseriatim dispositi, solitarii, in alabastro globoso-ovati, circa 4 mm. longi; super pulvinum prominentem basi bracteolatum siti. Calyx lato campanulatus, ferrugineo-pilosus, haud striatus, ad medium in lobos 3 rotundatos divisus, basi truncatus. Corolla calyce duplo longior, striata, apice acuta, puberula. Annulus staminalis in filamenta 6 aequalia abrupte subulata divisus. Ovarium loculis saepe 3 fertilibus praeditum, minute pubescens.

MALAY PENINSULA: *Kemaman*, Sungai Nipa (Corner, 30520).

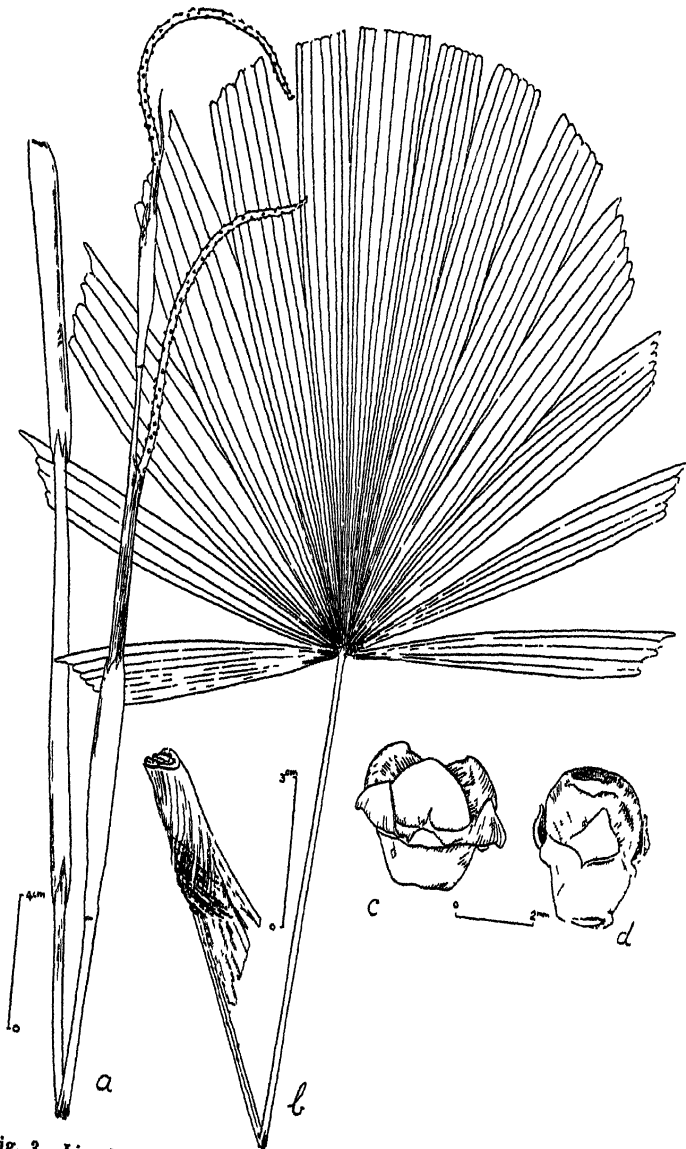


Fig. 3. *Licuala kemamanensis* (Holotypus: CORNER 30520).  
 a. Spadix. b. Frons. c. Flos tres carpella fertilia et unum  
 filamentum staminale exhibens. d. Flos cum uno carpello fertile.

This species appears to be very near to *L. ferruginoides*, a Sumatran species described to have simple partial inflorescences but known also to bear sometimes two spikelets to each spadix branch. *L. ferruginoides* is however a very tall species having much larger leaves and flowers, a zigzag axis to the spadices, the spikelets arising a little below the apex of the leaves.

The only peninsular species having simple partial inflorescences to simulate *L. kemamanensis* is *L. Kunstleri*, but the latter is readily distinguished from the former by the very long pedicels of its flowers, turbinate calyx, and glabrous ovary.

8. *Licuala Kiahii* Furtado sp. nov. Fig. 1.

*Palma* humilis acaulescens. *Petiolus* 60–70 cm. longus, praesertim ad basin versus rubescens, prope basin tantum spinis reduncis, remotis, 1–2 mm. longis armatus. *Segmenta* foliorum 5, rarissime 6–7, inaequalia; medianum 10–11 costatum, 20–25 cm. longum, apice 8–10 cm. latum, superficialiter obtuseque dentatum, cunctatissimum, sessile; altera 3–5 costata, mediano minora, oblique crosso-truncata, arcuato cuneata. *Spadix* petiolo duplo vel triplo brevior, basi cum pedunculo circa 20 cm. longo fusco-furfuraceo, spathis 3–4 tubulosis induto, suffultus, apice in inflorescentias partiales 2–3, simplices vel bifurcatas, furfuraceas, 3–4.5 cm. longas divisus. *Flores* in glomerulis 1–3, remotis, alterne vel spiraliter dispositi, sessiles, pulvino inconspicuo. *Calyx* furfuraceus, pubescens, in lobos acuminatos profunde partitus. *Corolla* calyce parum longior, pubescens, in lobos altos, acuminatos divisa. *Annullus* staminalis in sex filamenta abrupte subulata divisus. *Ovarium* glabrum; carpellis plerumque 1–2 vel saepius omnia evolutis. *Fructus* elongato-clavatus, saepe parum curvatus, circa 22–23 mm. longus, 3.5–4.5 mm. in diametro; semine conforme, osseo; fossa integumentali embryo dorsali supra basin obiecta, apicem versus mox ascedente cylindracea.

MALAY PENINSULA: *Johore*, in collibus apud ripas Sungai Kayu (Kiah, 32137, Holotypus); in monte (Gunong Pulai (Haniff, s.n., 27 Dec. 1925).

This species is very peculiar in the genus in that it has very long fruits borne on a compound spadix. The only other species known to produce such long fruits is *L. mattanensis* Becc. from Borneo, which however is characterised by many-lobed leaves, a simple, unbranched spadix having almost pedicellate flowers, and the integumental process in the seed situated on the same side as the embryo (not opposite the embryo as is the case with *L.*



Fig 4 *Licuala kiahii* (Holotypus KIAH 32127)

a Spadix b Planta cum spadice fructifero c Fructus  
d Fructus verticaliter discissus e Perianthium fructiferum f. Filamentum staminile

*Kiahii*). Otherwise *L. Kiahii* has many characters similar to those of *L. mattonensis*, even in the habit of developing frequently more than one fertile carpel in each ovary.

9. *Licuala Kingiana* Becc. in Malesia III (1889) 193; Hook. f., Fl. Brit. Ind. VI (1892) 131; Ridl., Mat. II (1907) 165; Becc. in Webbia V (1921) 38 et 51; Ridl., Flora V (1925) 30; Becc. in Calc. Annals XIII (1933) 213 t. 11-11.

MALAY PENINSULA: *Perak*, Bukit Kapayang (Ridley in Feb. 1904); Sungai Siput (Haniff & Nur, 6962); Gunong Keledang (Ridley, 9804); Kinta Valley (Ridley s.n.); Bujong Malacca (Curtis, 3162); Keledang Saiong (Symington, Cf. 25724 & 25612—Herb. Kepong).

The Bukit Kapayang specimen collected by RIDLEY has one spadix bifid at the apex.

10. *Licuala Kunstleri* Becc. in Hook. f., Flor. Brit. Ind. VI (1892) 433; Ridl., Mat. II (1907) 162; Becc. in Webbia V (1921) 30 et 41; Ridl., Flora V (1925) 27; Becc. in Calc. Annals XIII (1933) 167 t. 94.

MALAY PENINSULA: *Perak*, Temango (Ridley, 11709). *Pahang*, Tanjong Antan (Ridley in 1891); Sungai Lepar (Burkill & Haniff, 17160). *Selangor*, Ulu Gombak, alt. 1,500 ft. (Hume, 9437); Bukit Kutu (Casdani in 1899); Kuala Lumpur (Ridley in 1889); Gua Batu (Ridley in Dec. 1896).

Some specimens of this species have been distributed from Singapore under the name of *L. ferruginæ*.

11. *Licuala lanuginosa* Ridl. in Journ. Roy. Asiat. Soc. Straits Br. 44 (1905) 203, Mat. II (1907) 165; Becc. in Webbia V (1921) 33 et 46; Ridl., Flora V (1925) 30; Becc. in Calc. Annals XIII (1933) 181 tt. 9-IV et 50.

*L. longipes* sensu Ridl. op. cit. (1907 and 1925) pro parte.

MALAY PENINSULA: *Johore*, Gunong Panti (Ridley in Dec. 1892; Corner 30739 & 30739A); Gunong Belunul, alt. 2,200 ft. (Holtum, 10792); Gunong Pulai (Mat in 1892; Ridley 12198 partim; Best 7711; Corner in 1937); Bukit Tinjau Laut alt. 1240 ft. (Corner 37068).

12. *Licuala longicalycata* Furtado sp. nov. Fig. 5.

*L. baculariæ* affinis ut videtur, sed planta robustiore, foliorum segmentis latioribus, inflorescentiæ ramulis partialis pluribus, floribus majoribus, calyce floris longe piloso, sed fructus interdum laevi, corolla minute pubescente hæc species sat distincta. Inter species malayanæ *L. glabra* producit formas -spectu calycale similes *L. longicalycatæ*,

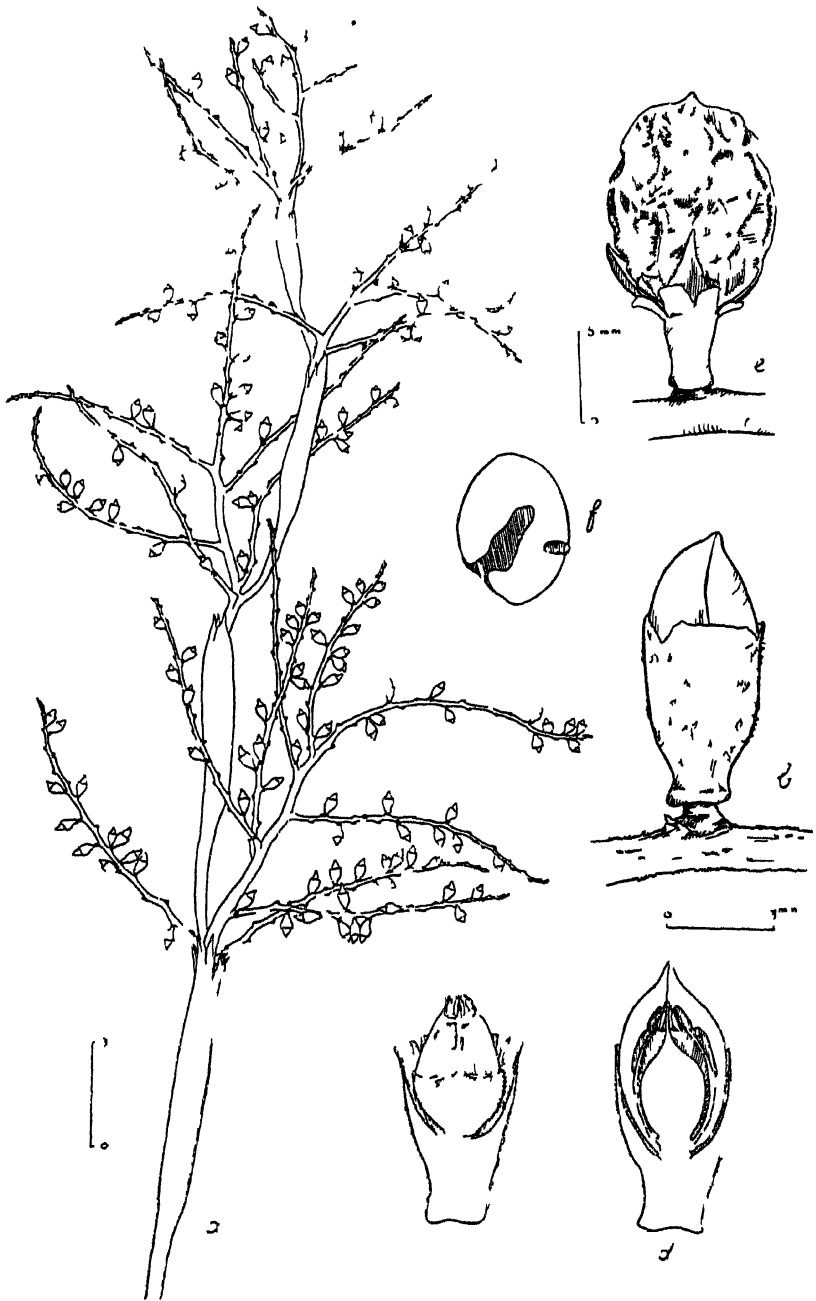


Fig. 5. *Licuala longicalcata* (Holotypus KIAH 32401)

a. Pars spadix flori b. Alabastrum c. Alabastrum verticaliter discissum ut aestivatio staminum appareat d. Alabastrum verticaliter discissum ut ovarium exhibeat e Fructus (e specimine SYMINGTON 47099) f Semen eucleom fructus aut alia de ...

a qua illa inflorescentiæ ramulis partialis paucioribus, calyce laevi apice arcuato denticulato (haud truncato et irregulariter fisso), pulvinis floriferentibus brevioribus differt.

*Caulis* robustus, ad 3 m. altus. *Petiolus* longus 1-3 m. longus, tertia parte basilari aculeatus, apice circa 8 mm. latus. *Segmenta* foliorum circa 16, inaequalia, cuneatissima; centrale latissimum, pluricostatum, apice obtuse dentatum, ad 9-16 cm. latum, 40-55 cm. longum; altera angustiora, altius dentata, 3-4 costata. *Spadix* circa 70-80 cm. longus, petiolo brevior, in 4-5 inflorescentias partiales, unasquisque 5-10 ramulosas, fugaceo fusco-furfuraceas ad apicem spathæ vel paulo infra orientes, divisus, axi flexuosus. *Flores* 6-8 mm. longi, super pedicellum prominentem 1-2 glomerulati, remoti, spiraliter dispositi; in alabaistro fusi-formes, striati, dense fugaceo-furfuracei. *Spathæ* tubulares, fugaceo furfuraceæ, parum inflatæ, apice parce marcescentes, basillares conspicue bicarinatæ. *Calyx* 4-5.5 mm. longus, gramineus, pilis longiusculis remotis præditus, cyathiformis, basin versus nonnihil angustatus, utrinque truncatus, apice superficialiter 3 lobatus, interdum in fructu irregulariter fissus. *Corolla* minute puberula, calyce sesqui vel duplo longior, segmentis lanceolatis, acutis, striatis, persistentibus. *Annulus* staminalis 6-fidus, lobis abrupte subulatis. *Ovarium* glabrum, gramineum, rarissime loculis fertilibus 2-3. *Fructus* in sicco oblongus, rugosus, circa 12-14 mm. longus, 10 mm. in diam; semen oblongum, 7 mm. longum, 5 mm. crassum; fossa albuminale indivisa, cylindrica.

MALAY PENINSULA: *Johore*, Sungai Kayu, in locis paludosis (Kiah, 32401, Holotypus); *Kluang* (Holtum, 9252); *Arong* (Symington, 47092—Herbarium Kepong); *Labis* (Symington, 47068—Herbarium Kepong). *Negri Sembilan*, Ayer Kuning, prope Bahau (Symington, 21379).

In BECCARI'S Key *L. longicalycata* would have to be placed near *L. paludosa* and *L. bintulensis*, from both of which it is readily distinguished by the longer calyx and the longer flower-bearing pulvini. The species also appears to be very near to *L. bacularia* which I know only from description, and which is a much smaller species having narrower leaf-segments, and more branches to the partial inflorescences. The only peninsular species which may be confused with *L. longicalycata* is *L. glabra*, especially those forms which have a longer calyx, but in the latter species the calyx is glabrous, arcuately denticulate and unlobed or unsplit, even when in fruit. The form, the colour and the pubescence of the calyx remind one of *L. modesta* and *L. tiomanensis*, both of which bear undivided partial inflorescences to the spadix. I have described the young flowers

from SYMINGTON 17068 where there is a portion of very young inflorescence mounted together with an older one; the veins and the thick furfur that is present on the flowers in bud disappear when the flowers are developed. The fruits are described from SYMINGTON 17092.

13. *Licuala longipes* Griff. in Calc. Journ. Nat. Hist. V (1845) 330 et Palms Brit. Ind. (1850) 125 t. 231 A & B; Hook. f., Fl. Brit. Ind. VI (1892) 131; Ridl., Mat. II (1907) 162; Becc. in Webbia V (1921) 28 et 12; Ridl., Flora V (1925) 27; Becc. in Calc. Annals XIII (1933) 155 t. 8-V.

MALAY PENINSULA: *Kemaman*, Ulu Bendong, Kajang, alt. 700 ft. (Corner, 30111). *Pahang*, Titi Bungor in Temerloh (Henderson, 10559); Mentakab (Holtum, 24560). *Negri Sembilan*, Gunong Angsi (Nur, 11571; Ridley, 10121); Tampin (Burkill, 1417); Gunong Tampin (Burkill, 1171; Holtum 9557); Beremban along Sungai Bendol (Furtado, 33125). *Malacca*, Ayer Panas (Goodenough, 1406; Ridley & Goodenough, 1577); Bukit Besar Ophir (Ridley, 10120 & 3471); Selandan (Ridley, 10793); Bukit Tampin (Goodenough, 1962).

*Distribution*: recorded from Mergui in Lower Burma.

GRIFFITH cites the syntypes of this species thus: "Malacca, solitary in dense forests, Ayer Punnus (Rhim), Goonoong Miring, and Mount Ophir, but not above an elevation of a thousand feet. Tenasserim coast in forests near Lincar to the south of Mergui."

BECCARI found only one syntype in the Calcutta herbarium with no indication as to its locality, and since he had not seen any specimen definitely coming from the Malay Peninsula, he gave Tenasserim as the probable origin of this GRIFFITH's specimen. However from the description and the drawings given by BECCARI I think the species is common in the Peninsula, especially in the regions where GRIFFITH saw it.

From the notes given by collectors it appears that this species is very common in Malacca and Negri Sembilan; also that though it is easy to find plants in flower, it is rare to find them in fruit. There are a few specimens which have been collected above a height of 1,000 ft., and in some of these the flower-bearing pulvini are quite prominent (*c.g.* BURKILL 1171 and HOLTUM 9957); but there are transitions between these and the usual forms where the pulvini are nested in depressions.

There is some variation in the dentation of the calyx; some split very early during the development of the flowers and here the lobes are rounded at the apex and are often bifid; in others this lobation is retarded and the calyx looks

almost truncate and later split irregularly as in *L. malajana*, a species which appears to have very close affinities with *L. longipes*.

GRIFFITH records that this species is known to Malays as *Palas Batu*, a name recently recorded also by a Malay collector who notes that the leaves are used for thatching house roofs.

14. *Licuala malajana* Becc., Malesia III (1889) 197; Hook. f., Fl. Brit. Ind. VI (1892) 131; Ridl., Mat. II (1907) 161 pro parte; Becc. in Webbia V (1921) 35 et 55; Ridl., Flora V (1925) 26 pp.; Becc. in Calc. Annals XIII (1933) 196 tt. 11 IV et 87.

MALAY PENINSULA: *Trenyganu*, Brang in Tersat, alt. 2,500 ft. (Kiah & Moysey, 33398). *Kemaman*, Kajang at Ulu Bendang, alt. 500 ft. (Corner, 30072 A); Sungai Nipa (Corner, 30547).

The following specimens have more hairy calyces, but seem to belong here:

*Kelantan*, Kuala Krai (Haniff & Nur, 10104). *Pahang*, Bukit Senai (Henderson, 19434). *Selangor*, Pahang Track (Ridley in 1897). *Johore*, Gunong Muntahak, alt. 600 ft. (Nur, 19968).

I have not seen any authentic specimens named by BECCARI and so my identification of the species is based entirely on the description and plates given by BECCARI. The specimens doubtfully cited here come very near to some forms of *L. modesta* which however produces very much shorter spadices bearing flowers in groups of two or three on very prominent, almost pedicelliform tubercles. The typical calyx of *L. malajana* has some resemblance to that of *L. Ridleyana*, but the latter species produces unbranched partial inflorescences.

15. *Licuala mirabilis* Furtado sp. nov. Fig. 6.

A *L. Kunstleri*, cui *peraffinis*, *spatha limbo pedicellum axillaris spicæ plerumque valde superante*, *spathis superne inflatis*, *spicis* (=inflorescentiis partialibus) 2-5 ramulosis *haec species sat distincta*. *Secundum clavem Beccarii analyticam prope L. baculariam ponenda, a qua spadicebus quam petioli valde brevioribus facile distinguitur*.

*Palma solitaria vel sobolifera, cum caule 1-1.5 m. longo 3-4 m. alta. Petiolus circa 15 m. longus, vagina fibrosa mox marcescente decidua præditus, in 2/3 partibus basalibus aculeis reducendis, inferioribus robustis 1 mm. altis, 1-2 mm. crassis, superioribus obscuris armatus. Segmenta frondium 20-27, basin versus valde angustata, fere petiolulata, apice 3.5-7 cm. lata, 5-15 mm. profunde dentata, 2-3, raro 4-6, costata; medianum alteris parum majus 3-6*

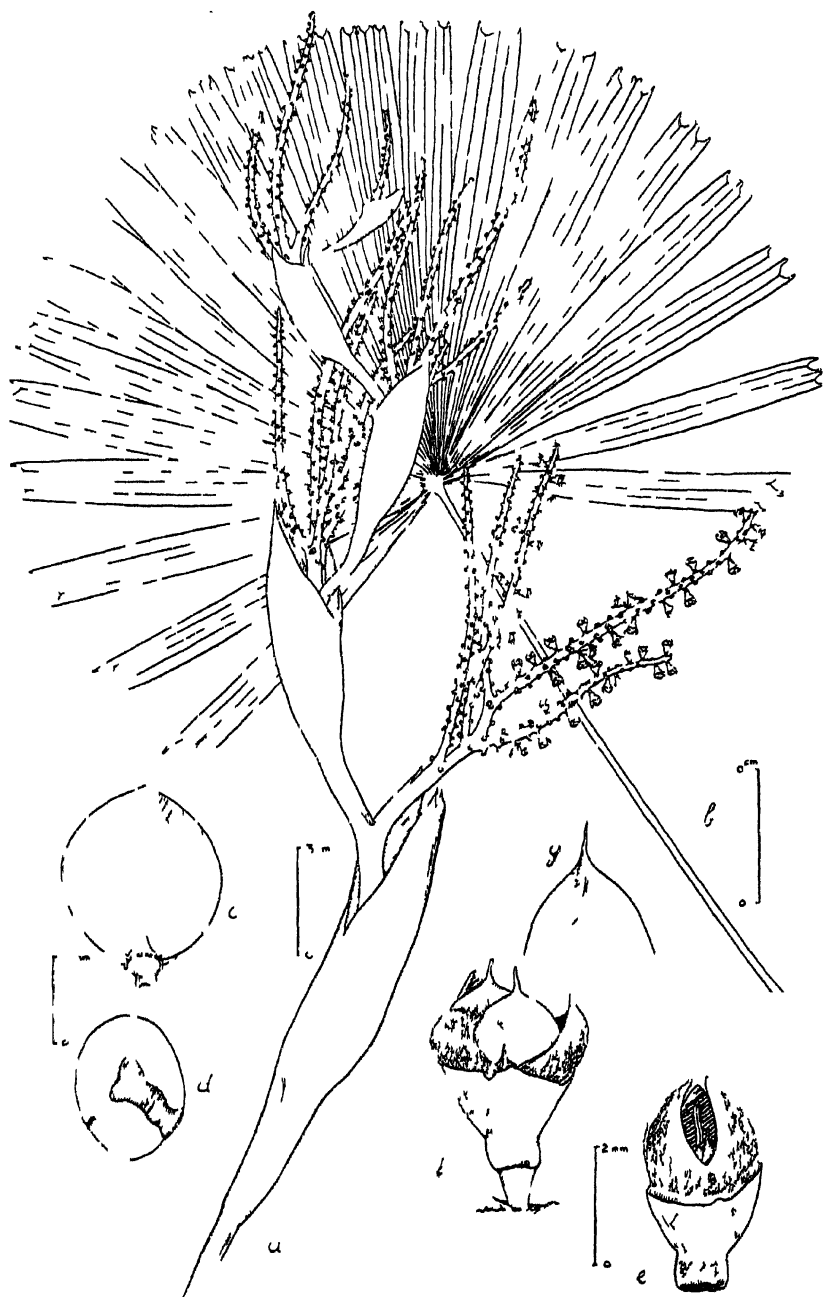


Fig. 6 *Lucuala mirabilis* (Holotypus LURADO 33054)

a. Pars spadiciis floridi b. Frondis lamina cum parte petiohi  
 c. Fructus d. Semen verticaliter discussum e. Alabastrum f. Pul-  
 vinus cum flore dua carpella fertiha exhibente g. Filamentum  
 staminale

costatum, minus profunde dentatum. *Spadices* petiolo multo breviores, ad 45 cm. longi. *Spathæ* fugaceo furfuracæ basi tubulosæ superne subito inflatæ, apice acutæ, in uno lateo fissæ, partem pedicellarem spicarum axillarium plerumque superantes. *Inflorescentia partialis* in spiculas 2–5 axi pubescentes divisa, pedicello ad 25 cm. longo, infra limbum spathæ axillantibus plerumque oriente, sæpe quam limbus spathæ minore. *Flores* conspicue pedicellati, geminati vel solitarii. *Calyx* turbinato campanulatus, pubescens, apice membranaceus, lobatus vel partim truncatoides, in basin cylindricam induratum abrupte constrictus. *Corolla* calyce duplo longior, dense sericea. *Annulus* staminalis in filamenta 6, aequalia superne abrupte subulata. *Ovarium* glabrum. *Fructus* globosus, utrinque acutus, 10–12 mm. longus, 6–8 mm. crassus; albumine carneo, albescenti, fossa integumentale cylindrica, vertice paulo dilatata, interdum biapicali.

MALAY PENINSULA: *Kedah*, Ayer Tërjang Valley in Baling (Furtado, 33054–Holotypus); Yan (Ridley in June 1893). *Province Wellesley*, Permatang Bertam? (Ridley in 1895); Bukit Mertajam, alt. circa 450 m. (Burkill, 9021). *Perak*, Bukit Merbau Balong in Kroh (Furtado, 33037).

This species is closely allied to *L. Kunstleri*, but the branching of the partial inflorescences distinguishes them at once, *L. Kunstleri* having always simple branches to the spadices. From *L. ferruginea*, with which *L. mirabilis* has been confused, it is distinguished by the non-marcescent apex of the spathes, the pedicelled flowers and the membranous calyx having an attenuate and constricted base.

16. *Licuala modesta* Becc., Malesia III (1889) 195; Hook. f., Fl. Brit. Ind. VI (1892) 433; Ridl., Mat. II (1907) 163; Becc. in Webbia V (1921) 35 et 48; Ridl., Flora V (1925) 28; Becc. in Calc. Annals XIII (1933) 198 tt. 14–VI et 88.

*L. Wrayi* Becc. ex Ridl. in Journ. Roy. Asiat. Soc. Straits Br. 82 (1920) 201; Becc. in Webbia V (1921) 37 & 50; Ridl., Flora V (1925) 28; Becc. in Calc. Annals XIII (1933) 210 tt. 13–I et 46. *Syn. nov.*

MALAY PENINSULA: *Perak*, Taiping Hills (Hervey, in 1889; Ridley, 14721, in Dec. 1902 and in Feb. 1904; Furtado, 37103); Kuala Kangsar (Ridley, 3167); Gunong Hijau (Fox sub Curtis no. 3529; Burkill & Haniff, 12873 & 12589, Anderson, 164 & 171); Tea Gardens (Ridley, 11406 and in Feb. 1891); Maxwell's Hill (Burkill & Haniff, 12948, & 12551; Ridley in June 1893 & Feb. 1892; Curtis, 2077 partim, ex altera parte=*Calamus* sp.); Gunong Pondok, alt. 1,000 ft. (Henderson, 23804); Box Hill, alt. 4,200 ft. (Fox, 163); Larut Hill (Anderson, 177).

I am unable to detect any appreciable differences between the forms described by BECCARI and RIDLEY as *L. Wrayi* and *L. modesta*. The species produces very short inflorescences; in some there may be a few partial inflorescences separated by more or less elongated tubular spathes; in others the number of branches and the size of the spathes are reduced, so that the entire spadix may appear to bear directly the spikelets on its axis, though one or two liguliform spathes about 3–6 cm. in length will indicate the reduction that has taken place in the spathes; and in still others the ligule may be further reduced into small, inconspicuous bracteoles. If the definition of LICUACELLA were accepted, the specimens bearing these small bracteoles could not be kept in the subgenus that includes *L. modesta*, a reason why BECCARI was obliged to erect *L. Wrayi*.

Some of the specimens cited above were referred by RIDLEY (1907 and 1925) to *L. malajana* and to *L. pusilla*.

**17. *Licuala Moyseyi* Furtado sp. nov. Fig. 7.**

*A L. Corneri, cui valde affinis, recedit hanc species: petiolis inermi; segmentis frondium inaequalibus, mediano latissimo; ramulis floriferis furfuraceis, haud pubescentibus; pedicellis fere tuberculiformibus; floribus in spicis inferioribus plerumque 2–3 glomeratis; calyce fugaceo furfuraceo, haud piloso, minore, apice conspicue 3-lobato.*

*Petiolus* gracilis, inermis, 75–90 cm. longus, ad basin circa 4 mm. latus, apice paulo angustior. *Segmenta* foliorum 8–10 dentibus 5–10 mm. altis; medianum latissimum, 10–11 costatum, 22–25 cm. longum, apice 10–15 cm. latum; altera angustiora, minora, 3–4, raro 2–5 costata; basilaria minima, apice oblique erosa. *Spadices* 60–75 cm. longi; in parte basilari haud ramosa, 35–40 cm. longa, spathis 2–3 involuti; in altera parte in ramos floriferos 3–4, simplices, fusco furfuraceos divisi. *Spathae* tubulares, fugaceo fusco furfuraceae, superiores obscure biangulatae, haud inflatae, ad 6 mm. crassae, apice oblique truncatae; infima latior conspicue biangulata. *Flores* in tuberculis prominentibus insidentes, 1–3 glomerati, 3–4 mm. longi, clavati. *Calyx* fugaceo fusco furfuraceus, conspicue 3-lobatus, in alabastro apice globosus, basin versus pedicelliformiter contractus. *Corolla* juvenilis tantum visa, haud pubescens. *Annulus* staminalis in filamenta aequalia abrupte subulata divisus. *Ovarium* glabrum.

**MALAY PENINSULA:** *Trengganu*, Gunong Padang, alt. circa 1300 m. (Kiah et Moysey, 31840).

This species may easily be confused with *L. Corneri*, for both have simple, unbranched partial inflorescences and they are the only species in the peninsula having a long pedicelliform base to the calyx. However *L. Moyseyi* can

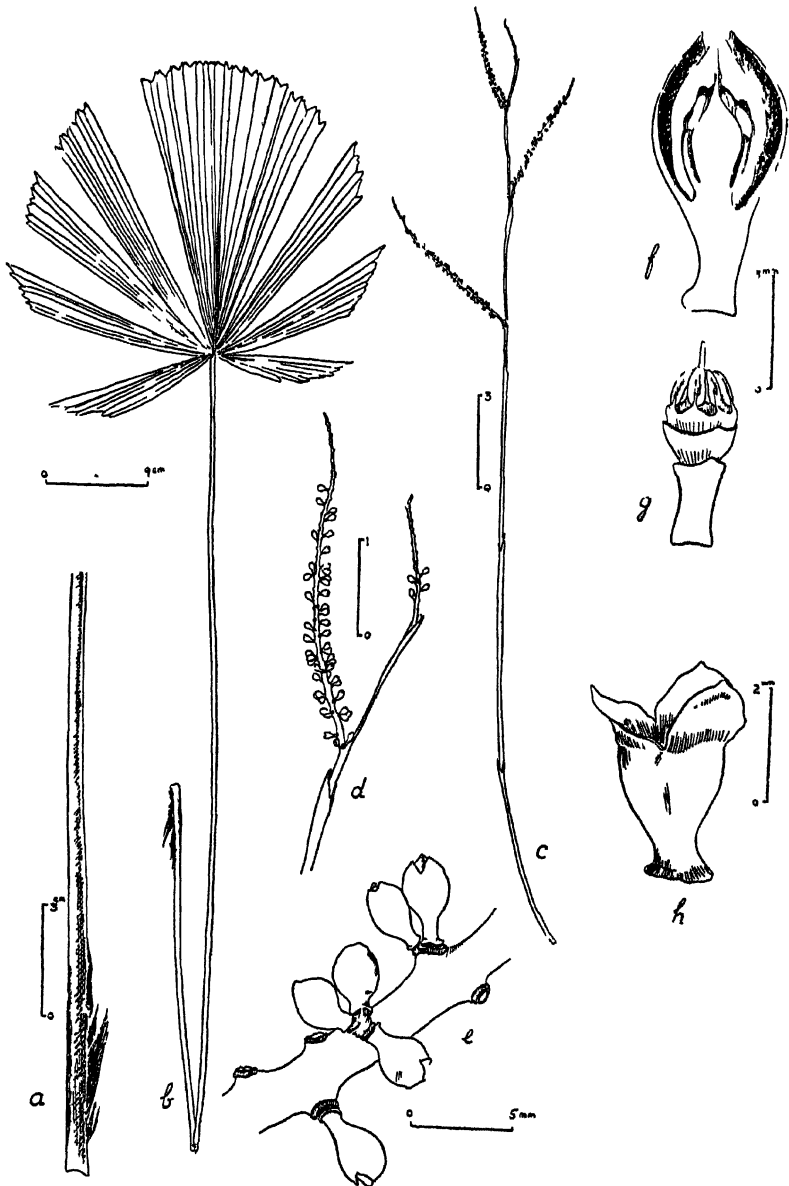


Fig. 7. *Licuala Moyseyi* (Holotypus: KIAH & MOYSEY 31840).

a. Petioli pars inferior. b. Frondis lamina cum petiolo. c. Spadix.  
 d. Pars ejusdem apicalis. e. Pars spicae ut dispositio florum appareat.  
 f. Alabastrum verticaliter discissum. g. Alabastrum sine perianthio  
 ut aestivatio staminum appareat. h. Calyx fructiferus.

be distinguished from *L. Corneri* by its thornless petiole; unequal leaf-segments, the median being 2–3 times broader than the others; furfuraceous, not hairy spikelets; smaller, almost tubercular flower-pedicels; flower-glomerules consisting frequently of 3 flowers; smaller, not hairy, and distinctly 3-lobes calyx.

The flowers present in the specimen are not fully developed, the reason why the description of the petals is so meagre. One fully developed calyx was found on a spadix from which all fruits had fallen off; this calyx is represented in the drawing to show the depth of the calyx lobes.

18. *Licuala pahangensis* Furtado sp. nov. Fig. 8.

*L. malajana* sensu Ridl., Mat. II (1907) 161 et Flora V (1925) 26 p.p.

*L. spinosa* sensu Ridl. in Trans. Linn. Soc. Lond. III (1893) 391 p.p.

*Inter species supdice composito ramulis floriferis simplicibus ponenda; L. Ridleyanae et L. peninsulari valde affinis, sed calycibus striatis, glabris, apice alto lobatis, basi truncatis vertice basali caudiculatis; petalis glabris; sat distincta.*

*Petiolus* 50–100 cm. longus, tertia parte basali aculeatus. *Segmenta* frondium subaequalia; centralia 4–6 costata, 3.5–5 cm. lata, circa 45 cm. longa, paulo latiora et minus profunde dentata alteris 2–3 costatis paulo brevioribus. *Spadices* petiolis fere aequilongi, vel eis paulo breviores, ramis simplicibus, ad 15–20 cm. longis, supra spathæ apicem remoto orientibus. *Spathæ* tubulosæ, fugaceo furfuraceæ. *Flores* solitarii, pluseriatim dispositi, circa 4–5 mm. longi. *Calyx* membranaceus, valde striatus, glaber, apice in 3 lobos asymmetros divisus interdum irregulariter fissus, basi truncatus vertice caudiculatus. *Corolla* glaber, calyce duplo longior. *Annulus* staminalis in filamenta versus apicem arcuatim angustata divisus. *Ovarium* glabrum, loculis saepe duobus vel tribus fertilibus. *Fructus* maturus ignotus.

MALAY PENINSULA: *Pahang*, ad radicem montis Gunong Senyum (Henderson, 22305–Holotypus); Titi Bungor, Temerloh (Henderson, 10623); Tanjong Antan (Ridley in 1891); Pulau Chengai (Ridley in 1891).

From the species bearing simple spadix-branches *L. pahangensis* is readily distinguished by the striate, glabrous calyx which is deeply lobed at the apex and truncate at the base, where it has a small tail-like projection. Otherwise this species may be easily confused with *L. peninsularis* and *L. Ridleyana*.

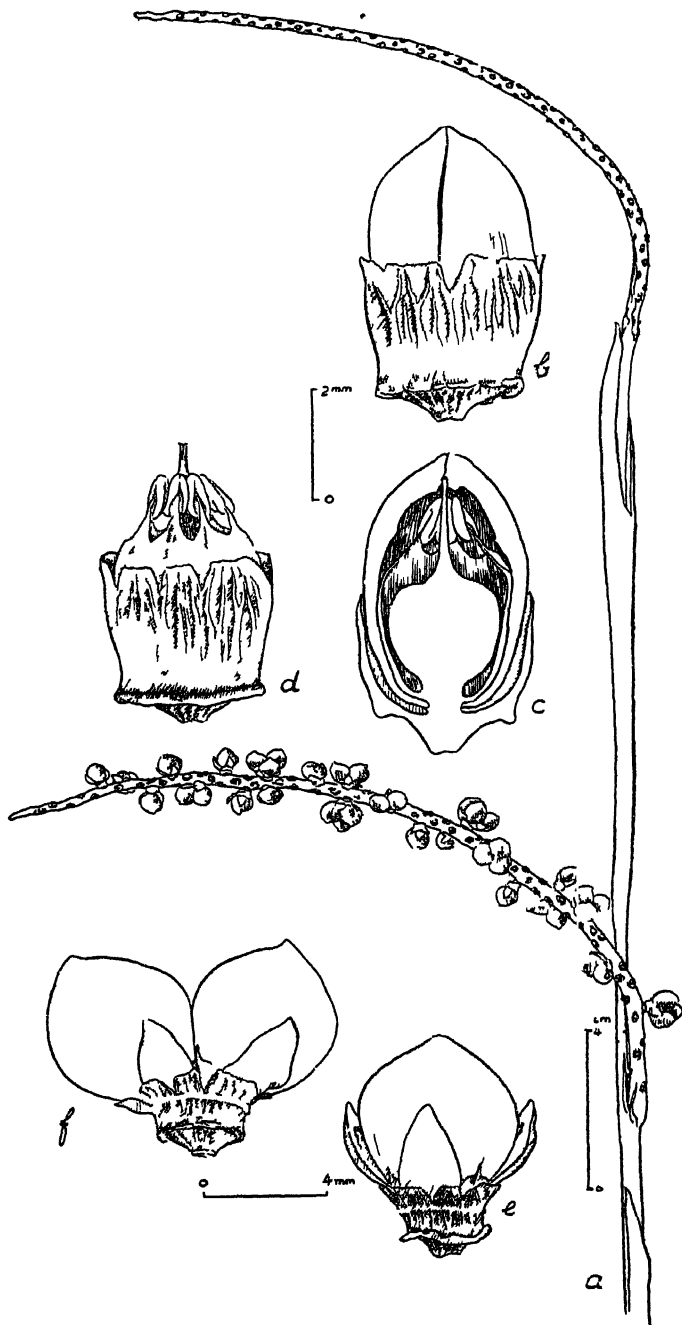


Fig. 8. *Licuala pahangensis* (Holotypus HENDERSON 22305).

a. Pars spadicea b. Alabastrum c. Alabastrum verticaliter discissum. d. Alabastrum, petala resecta, ut aestivatio staminalis appareat. e. Fructus immaturus monospermus. f. Fructus immaturus

19. *Licuala paludosa* Griff. in Calc. Journ. Nat. Hist. V (1843) 233 et Palms Brit. Ind. (1850) 118 tt. 221 A, B, et C; Hook. f., Fl. Brit. Ind. VI (1892) 130; Ridl., Mat. II (1907) 160 p.p.; Becc. in Webbia V (1921) 24 et 43; Ridl., Flora V (1925) 25 p.p.; Becc. in Calc. Annals XIII (1933) 159 tt. 8-XI, et 98.

*L. paniculata* Ridl. in Journ. Roy. Asiat. Soc. Straits Br. XLI (1903) 12, et Mat. II (1907) 163; Becc. in Webbia V (1921) 29 et 43; Ridl., Flora V (1925) 30; Becc. in Calc. Annals XIII (1933) 161 tt. 10-I et 46. **Syn. nov.**

*L. patens* Ridl. in Journ. Roy. Asiat. Soc. Straits Br. LXXXII (1920) 202 et Flora V (1925) 25. **Syn. nov.**

*L. spinosa* sensu Ridl. in Kew Bull. (1926) 91.

MALAY PENINSULA: *Perak*, Hermitage Hill (Ridley in 1892, Holotype of *L. paniculata*); Sungai Krian Estate, alt. sea level (Sparc, 33288); Gunong Bubu alt. 4,000 ft. (Wray, 3928, Haptosyntype of *L. patens*). *Selangor*, Sungai Tinggi, near Kuala Selangor (Nur, 34076). *Johore*, Hadji Senawi (Ridley, 11212).

SUMATRA, Siberut in Mentawi Islands (Boden-Kloss, 14614).

*Distribution*: Borneo and Indo-China.

RIDLEY has referred to this species many specimens of *L. spinosa*. Perhaps he had these specimens in mind when he erected *L. patens*.

*L. paludosa* is easily distinguished from *L. spinosa* by its calyx being minutely puberulous or almost glabrous outside and irregularly and shortly lobed at the apex. I do not find any important difference between the specimens collected in the lowlands and those collected in the mountains, and so I have reduced *L. patens* to a synonym of *L. paludosa*. There are some small differences noticeable between the types of *L. paniculata* and *L. paludosa*, but there are transitions; but even without these transitions the differences are so trivial that I have no hesitation in reducing *L. paniculata* to *L. paludosa*. (These differences have been noticed by BECCARI in *Calcutta Annals l.c.*).

In erecting *L. paniculata* (1903) RIDLEY remarked that it and *L. penduliflora* from New Guinea were the only species known to him to have a "panicked" inflorescence, which, according to him, characterise the section PERICYCLA. Since he did not include in this section *L. paludosa*, *L. longipes* and *L. patens*, even in his most recent work (1925), it is not easy to understand RIDLEY's conception of the section PERICYCLA (sometimes spelt by RIDLEY as *Pericyclus*).

BECCARI has reduced *L. amplifrons* Miq. to *L. paludosa*, but the specimens growing under that name in the Botanic Gardens, Buitenzorg, Java, appear to be different, though BECCARI quoted material from these plants under *L. paludosa*. In 1936 I collected herbarium material from these plants in Buitenzorg and distributed it under the Singapore Field no. 31102 and 31129. The plants can be distinguished from the typical *L. paludosa* in being solitary, bearing shorter petioles, fewer branches to partial inflorescences, longer flower-bearing pulvini, and sometimes the flowers borne in pairs on each pulvinus. The material looks so different that a further inquiry into the status of *L. amplifrons* Miq. seems to be necessary.

20. *Licuala pusilla* Becc., Malesia III (1889) 194; Hook. f., Fl. Brit. Ind. VI (1892) 433; Ridl., Mat. II (1907) 164; Becc. in Webbia V (1921) 31 et 45; Ridl., Flora V (1925) 28; Becc. in Calc. Annals XIII (1933) 174 t. 85.

*L. acutifida* sensu Ridl. op. cit. (1907) 163 et (1925) 27. p. parte.

MALAY PENINSULA: *Kelantan*, Gua Ninck (Henderson, 19686). *Selangor*, Rantau Panjang (Hume 7619; Ridley in Aug. 1909); Kanching (Foxworthy and Burkill on 30 Nov. 1921). *Negri Sembilan*, Gunong Angsi (Ridley in Feb. 1904). *Malacca*, Sungai Udang (Goodenough, 1360 as Palas Padi).

Of this species I have not seen any specimens named by BECCARI, and so my identification of it is based entirely on BECCARI's description and plate. The young floriferous branches are covered with whitish tomentum.

This species appears to be very near to *L. triphylla* some forms of which bear many, narrow almost linear segments to the leaves, the median lobe being sessile. Further investigation in the field may prove *L. pusilla* to be only a form or variety of *L. triphylla*.

21. *Licuala Ridleyana* Becc. in Webbia V (1921) 31 et 44 et in Calc. Annals XIII (1933) 170 tl. 10-III et 34.

*L. malajana* sensu Ridl., Mat. II (1907) 161 et Flora V (1925) 26 p.p.

MALAY PENINSULA: *Perak*, Bujong Malacca (Ridley, 9805, et 9806, Haptoparatype of *L. acutifida* var. *peninsularis*).

From the description and drawings given by BECCARI and from the Singapore duplicates of the specimens cited by BECCARI, the flowers of the specimens cited under *L. Ridleyana* and *L. acutifida* var. *peninsularis* (see *L. confusa*) appear to have been interchanged either by RIDLEY at the

time of distributing his collections or by BECCARI at the time of drafting his description. In the Singapore herbarium spadices of RIDLEY 9806 (cited by BECCARI under *L. acutifida* var. *peninsularis*) and RIDLEY 14112 (Haptoholotype of *L. Ridleyana*) still bear flowers; but RIDLEY 9806 has flowers depicted for *L. Ridleyana* and RIDLEY 14112 has flowers depicted for *L. acutifida* var. *peninsularis*. As I have typified the species on the characters of flowers, which are more stable and of better diagnostic value than the characters of leaves, spathes, etc., investigators should note these points in case discrepancies be noticed in the original specimens of these two taxonomic units.

As described by BECCARI, *L. Ridleyana* approaches very near to *L. malajana* which has however branched partial inflorescences. (see also observations under *L. confusa*).

22. *Licuala Scortechinii* Becc., *Malesia* III (1889) 192; Hook. f., *Fl. Brit. Ind.* VI (1892) 434; Ridl., *Mat.* II (1907) 164; Becc. in *Webbia* V (1921) 37 et 49; Ridl., *Flora* V (1925) 30; Becc. in *Calc. Annals* XIII (1933) 208 tt. 13-IV, 59 et 59 bis.

MALAY PENINSULA: *Kedah*, Gunong Jerai =Kedah Peak (Haniff in May 1901; Ridley, 5201; Robinson and Kloss, 6016).

This species was based on a specimen collected by SCORTECHINI in Perak where it has not been found again.

23. *Licuala spinosa* Wurm in *Verh. Bat. Genootsch.* II (1780) 469; Bl., *Rumphia* II (1844 ?) 39 tt 82 et 88; Hook. f., *Fl. Brit. Ind.* VI (1892) 431; Ridl., *Mat.* II (1907) 160; Becc. in *Webbia* V (1921) 34 et 47; Ridl., *Flora* V (1925) 25; Becc. in *Calc. Annals* XIII (1933) 186 t. 84.

MALAY PENINSULA: *Perlis*, Mata Ayer (Henderson, 23061). *Kelantan*, Sungai Keteh (Nur, 12077). *Lankawi*, common (Curtis, 2129); Coah (Curtis, 3419). *Pahang*, Pekan (Ridley on Aug. 20, 1889); Tasck Bera (Henderson, 21433); Pulau Tioman (Nur, 18901; Burkill in June 1915). *Perak*, Dindings (Ridley, 3170); Matang Jambu (Wray, 2527). *Malacca*, Bukit Bruang (Hassan, 25). *Johore*, Sungai Segal in Muar (Fox, 11303); Sungai Rhu (Corner, 28485); Sungai Sedili in Mawai (Holttum & Corner, on 16 May 1932); Pulau Tinggi (Feilding in 1892). *Singapore*, Pulau Ubin (Ridley, 5121 et 3166; Hullett on 9 Nov. 1884); Pulau Battam (Ridley in 1890 and in 1891), Pulau Brani (Ridley in 1900); Changi (Ridley in April 1889).

*Distribution:* Lower Burma, Siam, Indo-China, Andamans, Sumatra, Java, Borneo, and the Philippines.

24. *Licuala tiomanensis* Furtado sp. nov. Fig. 9.

*Inter species inflorescentias partiales simplices gerentes calyce majore superficialiter lobato dense adpresse piloso sat distincta. Facie florum L. modestæ similis, sed spadicebus longioribus, inflorescentiis partialibus remotioribus simplicibus dissimilis.*

*Palma humilis. Petiolus unicus tantum visus, 22 cm. longus, infra medium aculeatus. Segmenta foliorum multa, inaequalia, cuneata; medianum maximum, circa 28 cm. longum, 9 cm. latum, pluricostatum; basilaria 2-costata, minima, 15-17 cm. longa, circa 2 cm. lata; intermedia 3-4 costata. Spadix circa 80 cm. longus, in ramos 2-3, pilosos, simplices, infra spathæ apicem orientes divisus. Spathæ tubulosæ, fugaceo-furfuraceæ. Flores immaturi lanceolati, 6-8 mm. longi, super pulvinos prominulos plerumque geminati. Calyx 4 mm. longus, dense pilosus, apice truncatus, breviter lobatus vel in 3 lobos obscure fissus. Corolla ante anthesin calyce  $1/3$  longior, puberula, lobis acutis. Annulus staminalis conspicuus, in 6 filamenta abrupte subulata divisus. Ovarium glabrum.*

MALAY PENINSULA: *Pahang*, Bukit Kajang in insula Tioman, alt. 3,300 ped. (Nur, 18611).

This species resembles *L. Ridleyana*, *L. peninsularis*, etc. in having simple branches to the spadix, but in the characters of the flowers it is easily confused with *L. modesta*. Unfortunately *L. tiomanensis* is known only from a single specimen containing only one leaf which may not be typical of the species. Fruits are not known.

NUR, 18910 collected also on Gunong Kajang in Pulau Tioman at an alt. 2,500 ft. seems to belong here, but no flowers are present in the Singapore herbarium, though from the collector's notes it appears that the flowers were present in the collection. The petiole is very much longer in this specimen and may have been over  $3\frac{1}{2}$  feet long; the partial inflorescences arise very high above the apex of the spathes. The collector notes that the plant which supplied this specimen is 15-20 feet in height.

25. *Licuala triphylla* Griff. in Calc. Journ. Nat. Hist. V (1845) 332 et Palms Brit. Ind. (1850) 126 t 225; Hook. f., Fl. Brit. Ind. VI (1892) 432; Ridl., Mat. II (1907) 163; Becc. in Webbia V (1921) 33 et 46; Ridl., Flora V (1925) 28 t. 211; Becc. in Calc. Annals XIII (1933) 182 tt. 9-V et 96.

*L. pygmaea* Merr. in Univ. Calif. Publ. Bot. XV (1929)  
20. *Syn. nov.*

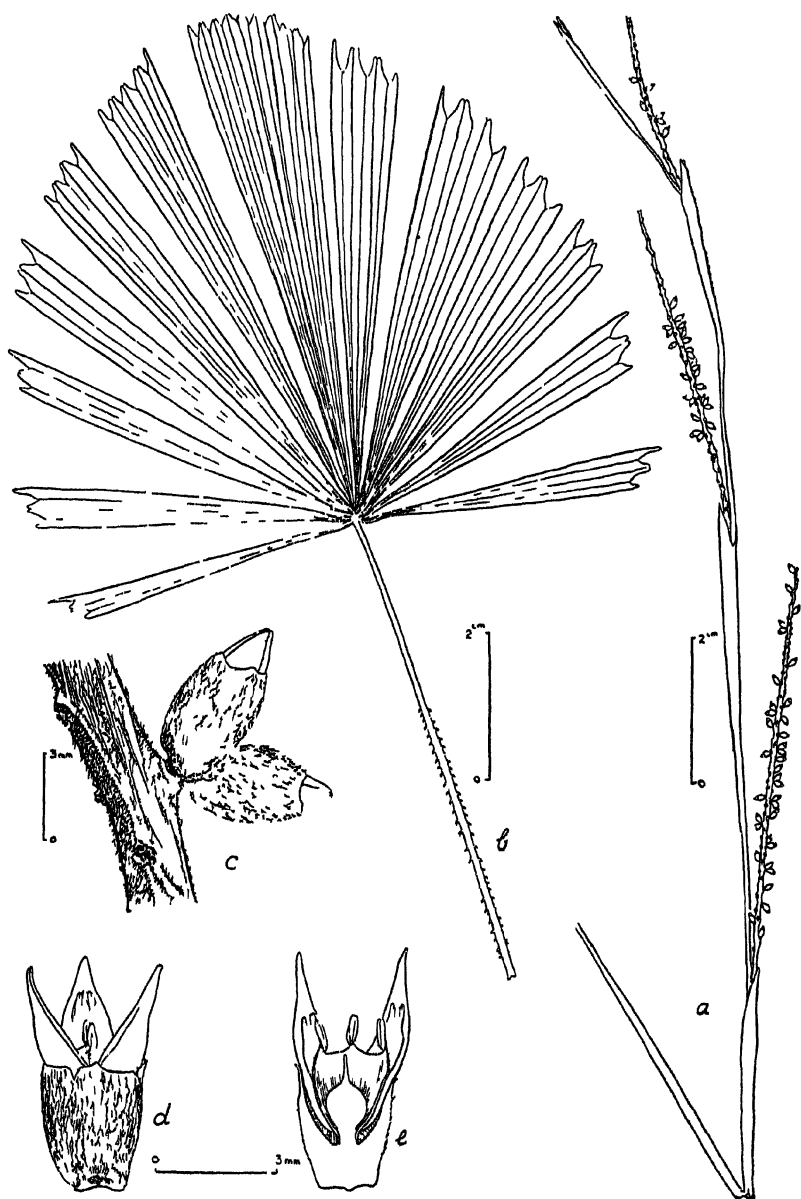


Fig. 9. *Licuala tiomanensis* (Holotypus: NUR 18611).

a. Pars spadicea. b. Frondis lamina cum parte petioli. c. Pars spicae cum alabastris. d. Flos ad anthesin. e. Flos verticaliter discissus ut filamenta staminum et ovarium appareant.

*L. triphylla* var. *integrifolia* Ridl., Mat. II (1907) 164; Becc. in Webbia V (1921) 33 et 46; Ridl., Flora V (1925) 28; Becc. in Calc. Annals XIII (1933) 184. **Syn. nov.**

**MALAY PENINSULA:** *Kedah*, Bukit Seblak at Weng (Furtado, 33069). *Pahang*, Gunong Senyum (Henderson, 22356); Batu Talam near Raub (Burkill & Haniff, 16959); Lubo Pellang (Ridley in 1891, the holotype of the var. *integrifolia*); Pulau Tijou (Ridley in 1891); Dong near Raub (Burkill & Haniff, 16911). *Perak*, Kroh (Furtado, 33041); Bujong Malacca (Curtis in Aug. 1898); Gunong Tungul in Dindings (Ridley in May, 1896 and July 1898). *Negri Sembilan*, Tampin (Burkill, 3212; Nur 1308). *Malacca*, Chabau (Alvins, 2306 as Palas Revang); Ayer Panas (Ridley & Goodenough, 1628); Malacca Town (Alvins, 655, as Gurcheng or Palas Tikus); Bukit Bruang (Curtis, in May 1901). *Johore*, Sungai Tebrau (Ridley, 13234); Bukit Keara in Muar (Fox, 11301; Ridley in 1902); Sungai Buloh Kasap (Corner on 5 Jan. 1936); Bukit Tinjau Laut (Corner, 37079). *Singapore*, Changi (Ridley in 1891 & 1894).

**BRITISH NORTH BORNEO:** Tawao (Elmer, 21635, Haptosyntype of *L. pygmaea*).

**Distribution:** Bangka (?) *vide* Beccari.

*L. triphylla* is a very variable species as regards the number of the leaf segments and the size of the petiolule of the median segment, some median segments being quite sessile. Owing to these variations field studies are necessary to see whether *L. pusilla* is a special form of this species. *L. triphylla* flowers when the plants are very small, so that leaves showing no divisions or leaves partially divided into 2 or 3 lobes may be found. In the holotype of *L. triphylla* var. *integrifolia* some leaves have very narrow segments at the base; these have been ignored by RIDLEY in describing the variety. Transitions from this to many-segmented leaves are many.

Many leaves bear sessile median segments, so that this cannot be taken as an invariable character of the species. GRIFFITH'S plate depicts leaves with sessile median lobes and so also RIDLEY'S figure which appears to have been based mainly on GRIFFITH'S plate.

I cannot separate *L. pygmaea* from *L. triphylla* on any characters. The median segment in the duplicate specimen in Singapore shows a distinct tendency to petiolulation.

## 6. Summary and Conclusions

This paper contains the results of a study of the *Licuala* species indigenous in the Malay Peninsula.

Though *Licualas* present little difficulty for collecting herbarium specimens, yet they are not well represented in the herbarium. The principal reason for this is that some experience is required before the collector is able to distinguish between the different species he meets with in the field, and so very often rare species, being mistaken for the common ones, are omitted in the collection. Hence some hints are given in this paper to enable the collector to distinguish readily between the species of a given area.

An inquiry into the affinities of the Malayan species revealed the necessity of revising the subdivisions of the genus. The previous subdivisions were mostly based on the branching of the spadices, a character very variable and therefore unsatisfactory for the purpose. It has been found also that all *Licuala* species produce a dorsal embryo in the fruit so that the definition that PERICYCLA includes species with basal embryo is untenable. The only stable character which can be employed to place allied species into large groups is found in the andræcium, and in the nature of its divisions.

As revised here, the genus *Licuala* consists of three subgenera: LIBERICULA (new), EU-LICUALA and PERICYCLA, the second subgenus being again subdivided into four sections: WURMBIA (new), BONIA (new), BECCARIA (new) and DAMMERA (new state). The subgenus LIBERICULA and the sections BONIA and BECCARIA are monospecific, containing respectively: *L. peltata* (in monsoon forests in North-East India, Assam, Burma, Andamans and Thailand (Siam)), *L. fatua* (Indo-China) and *L. reptans* (Borneo). Of the section DAMMERA only two species are known, both from New Guinea. The subgenus PERICYCLA has been re-defined to include all the species which are allied to *L. penduliflora* (Bl.) Miq., the type of the subgenus; these inhabit the tropical and sub-tropical regions in Oceania, one occurring in Australia, a few in the small islands west of the Solomon Islands, and the rest in New Guinea. The section WURMBIA includes the great majority of the *Licuala* species, the greatest number of these being limited to the Malay Peninsula, Sumatra and Borneo, though some also occur outside this region in Burma, Indo-China, South China, Java, Philippines, Celebes and New Guinea. Usually the distribution of the individual species of this section is very limited; *L. spinosa*, the type of the section, is the most widespread, being also of a frequent occurrence throughout the Malay Peninsula.

There are in all twenty-five species indigenous in the Malay Peninsula. Of these *L. peltata* is the only species that is not a member of WURMBIA. Besides *L. peltata* and

*L. spinosa*, four peninsular species are known or reported to occur wild outside the Malay Peninsula, namely *L. ferruginea*, *L. longipes*, *L. paludosa* and *L. triphylla*; they are also fairly widespread within the Peninsula itself. The other nineteen are all endemic, most of them being apparently restricted to small regions in the Peninsula. Much of this endemism may be more apparent than real, because, owing to the difficulty of distinguishing *Lacualas* in the field, the species are not well represented in the collections. Furthermore, recent collections from Sumatra, Borneo, and Siam have not yet been worked out.

The new name *L. Beccariana* has been proposed for the New Guinea species, previously known as *L. racemosa* Becc. (DAMMERA), non *L. racemosa* Bl. (WURMBIA). In addition nine new species have been described from the Malay Peninsula: *L. confusa*, *L. Corneri*, *L. kemamanensis*, *L. Kiahii*, *L. longicalycata*, *L. mirabilis*, *L. Moyseyi*, *L. pahangensis*, and *L. tiomanensis*.

The following names have been reduced in the synonymy: *L. acutifida* var. *peninsularis* (*L. confusa*, doubtful), *L. longepedunculata* (*L. glabra*), *L. paniculata* and *L. patens* (*L. paludosa*), *L. pygmaea* (*L. triphylla*), *L. racemosa* Becc., non Bl. (*L. Beccariana*), *L. triphylla* var. *integrifolia* (*L. triphylla*) and *L. Wrayi* (*L. modesta*).

It has been shown that *L. ferruginoides* produces at times branched partial inflorescences (vide observ. sub. *L. ferruginea*) and that a further inquiry is needed before Beccari's reduction of *L. amplifrons* to *L. paludosa* can be accepted as final.

## 7. Index to the Collector's Numbers

Alvins: 655 & 2306(25). Anderson: 164(16); 171 & 177(16). Best: 7711(11); 13884(5). Boden-Kloss: 14614(19). Burkill: 1171 & 1417(13); 3212(25); 9021(15). Burkill & Haniff: 12551 & 12589(16); 12873 & 12948(16); 16911 & 16959(25); 17460(10). Burkill & Holttum: 7842(5); 8426(6). Corner: 28485(23); 28688(4); 30072(3); 30072A(14); 30111(13); 30398(4); 30520(7); 30547(14); 30739(11); 37068(11); 37079(25). Curtis: 1010(1); 2077(16); 2129(23); 3162(9); 3419(23). Derry: 633(5). Elmer: 21635(25). Fox: 163(16); 3529(16); 11301(25); 11303(23). Furtado: 33037 & 33054(15); 33069(25); 33125(13); 37103(16). Goodenough: 1360(20); 1406(13); 1962(13). Haniff & Nur: 4720(A); 6962(9); 8111(5); 10104(14). Hassan: 25(23). Henderson: 10559(13); 10623(18); 19434(14); 19686(20); 22305(18). 22356(25); 23061(23); 23804(16); 24433(23);

29725(5); 33041(25). **Holtum**: 9252(12); 9260(4); 9557(13); 10601(16); 10605(4); 10792(11); 24560(13); 24944(4). **Hullett**: 852(5). **Hume**: 7619(20); 7962(2); 9437(10). **Kiah**: 24256(5); 32137(8); 32401(12). **Kiah & Moysey**: 31840(17); 33398(14); 33399(6). **Kloss**: see **Boden-Kloss**. **Lobb**: 280(1). **Moysey**: see **Kiah & Moysey**. **Nur**: 1308(25); 11571(13); 12077(23); 18611(24); 18901(23); 18910(24 obs.); 19968(11); 25167(4); 34076(19). **Ridley**: 3166(23); 3167(16); 3168(4); 3170(23); 3473(5); 3474(13); 3512(4); 5121(23); 5201(22); 6676(4); 7894(5); 9804(9); 9805(21); 9806(21) 10120(13); 10121(13); 10239(2 obs.); 10329(2 obs.); 10793(13); 11212(19); 11406(16); 12117(6); 12198(11); 13234(25); 13519(4); 14112(2); 14709(10); 14721(16); 15881(6). **Ridley & Goodenough**: 1577(13); 1628(25). **Robinson & Kloss**: 6016(22). **Spare**: 33288(19). **Symington**: 24379(12); 24380(4); 25612(9); 25724(9); 47068(12); 47092(12).

## 8. Index to the Botanical Names

Sectional and Subgeneric names in small CAPITALS. New names in **bold faced type**. Synonyms in *italics*.

### BECCARIA

#### BONIA

**DAMMERA** tr. nov.

*DAMMERA* subg.

#### EU-LICUALA

#### LIBERICULA

#### LICUACELLA

#### Licuala:

*acutifida*

*acutifida* var. *pcuinsularis* (obs.)

*amplifrons* (obs.)

*Beccariana* nom. nov. (gen.)

*confusa* sp. nov.

*Corneri* sp. nov.

*ferruginea*

*ferruginoides* (obs.)

*glabra*

*glabra* var. *selangorensis*

*grandis* (gen.)

*kemamanensis* sp. nov.

*Kiahii* sp.n.

*Kingiana*

*Kunstleri*

*lanuginosa*

*longepedunculata*

*longicalycata* sp.n.

*malajana*

#### Licuala:

*mirabilis* sp.n.

*modesta*

*Moyseyi* sp.n.

*pahangensis* sp.n.

*paludosa*

*paniculata*

*patens*

*peltata*

*pusilla*

*pugmaea*

*racemosa* (gen.)

*Ridleyana* (obs.)

*Rumphii* (gen.)

*Scortechinii*

*spinosa*

*tiomanensis* sp.n.

*triphylla*

*triphylla* var. *integrifolia*

*Wrayi*

#### LICUALINA

#### LICUALOPSIS

*Pericycla* emend. (obs.)

#### PERICYCLA

#### WURMBIA

## THE FERN GENUS DIPLAZIUM IN THE MALAY PENINSULA

by R. E. HOLTTUM

### General

The ferns of the genus *Diplazium* occurring in the Malay Peninsula are all, with the exception of *D. esculentum* and *D. polypodioides*, found on the ground in shady forest, many of them only in moist places near streams. They are especially characteristic of the valleys at medium elevations in the mountains, though a few species are common in the more open parts of the forest. There are no epiphytes and no climbing species among them. Nearly all have short erect rootstocks (sometimes developing a short trunk) and tufted fronds, sterile and fertile fronds being almost alike.

There is comparatively little difference of external form among the species of the same degree of division (*i.e.*, among pinnate and among bipinnate species), and there is of course a certain amount of variation according to age and influences of habitat, so that the clear distinction of species is at first sight difficult, and there has in fact been much confusion in the past. I have found, however, that the characters of the scales are most useful in distinguishing species of similar habit, and I believe that I have arrived at a clear distinction of our local species, with the possible exception of *D. Prescottianum*.

I have been unable to identify four of our species with any described from places outside the Peninsula, and so have described them as new. There are undoubtedly a very large number of species within the Malayan region, but I think that a good many have been described more than once. The descriptions are, however, inadequate as a basis for comparison, and much herbarium material is incomplete (part only of a leaf, or lacking in scales, or representing an immature stage). A study of much material over a wide area is necessary before a proper account of the genus in the Malayan region can be given.

*Diplazium cordifolium* provides a remarkable case of polymorphism leading to confusion of names. Young plants develop rather large simple fronds which are often fertile, and this stage may persist indefinitely, especially in the lowlands. Mature plants, however, often bear pinnate fronds with several pairs of pinnæ. The two stages have been separately named; and the fact that other superficially similar simply pinnate species have sometimes a few veins anastomosing has also led to confusion between these and the mature form of *D. cordifolium*. The young

stages of species may be characteristic, and so useful diagnostically, in this genus as in other fern genera, but they have been little studied. I have noted especially the early stages of *D. bantamense* and *D. riparium*.

In the following account of the species found in the Malay Peninsula, I have not attempted to give full lists of synonyms. There has been so much confusion in the application of names that such lists of synonyms would be difficult to compile accurately. I believe that the names used are all correctly applicable to our species; but I differ in some cases from the usage of the recent book by Backer and Posthumus on the ferns of Java. In such cases, the synonymy is briefly discussed.

As regards citation of specimens, this is done only where I believe there has been confusion in the past, or in the case of new species; in cases of well characterized species such as *D. accedens* and *D. cordifolium* there seems no need for the publication of lists of specimens. Specimens collected in our Singapore Field Number series (started by Burkill in 1912) are cited as S.F.N. Duplicates of many of these will be found in other herbaria, in some cases under other names than those now given. A list of numbers at the end of this paper may therefore prove helpful. It should be noted that the earlier distribution labels did not bear the words "Singapore Field Number".

A fairly full description is given for each species. To aid in the identification of specimens, the most distinctive characters in each description are italicised.

### Distribution

Until a full investigation is made, it is impossible to give a complete picture of the distribution of the species of *Diplazium* found in the Malay Peninsula. There are certainly cases in which one name is used in different countries to cover different species, and conversely the same species sometimes goes by different names in different countries. From the material at my disposal in the Singapore herbarium, it is, however, possible to make a few generalizations.

A few Malayan species certainly have a wide distribution, notably the two that grow in open places, *D. polypodioides* and *D. esculentum*. These both appear to extend from N. India and S. China right through the Malayan region to N. Guinea or beyond. *D. polypodioides* has various synonyms, and it appears that specimens from India and China need checking against the Java type.

*D. accedens* may have an even wider distribution if it should be found indistinguishable from *D. proliferum*, of which the type comes from the Mascarene Islands. A

similar case is that of *D. silvaticum* (type from Mauritius), but this is a less well characterized species, and its true Asiatic distribution is in doubt.

*D. sorzogonense* is another interesting case of a widely distributed species. This has undoubtedly been confused with *D. speciosum* and probably also with other species, but I have seen quite typical specimens from the Philippines and New Guinea. It is perhaps significant that this species is found in lowlands and mountains alike in Malaya, and is not confined to the most moist and shady places. *D. speciosum*, on the other hand, is certainly more restricted in distribution, and in Malaya is only found in the mountains, the typical form only (hitherto) on G. Tahan on the east side of the Peninsula.

*D. montanum* is a case of more restricted distribution. Our ferns which I now so name were formerly called *D. pallidum*. The latter species, however, as found on the mountains of Java and Sumatra, is clearly distinct, and I find that our ferns agree with the type of *D. montanum* from Sumatra. *D. montanum* appears to occur at lower altitudes in east and south Sumatra; i.e., those parts adjacent to Malaya.

*D. heterophlebium* is our only case in this genus of a species finding the southern limit of its distribution in Malaya.

So far as our present knowledge goes, the following species appear to be confined to the Malay Peninsula: *D. insigne*, *D. subintegrum*, *D. velutinum*, *D. procumbens*, *D. Kunstleri*, *D. simplicivenium*. All these are ferns of the moist, shady mountain valleys.

*D. insigne* is a remarkable fern of the alliance of *D. accedens* but very large. *D. subintegrum* is allied to *D. pallidum* but in my opinion quite distinct. *D. velutinum* is probably the most local of all, a derivative of *D. tomentosum*. *D. procumbens*, *D. Kunstleri* and *D. simplicivenium* are distinct members of the very large bipinnate group, the Peninsular species of which have been mostly hitherto lumped under the names *D. dilatatum* or *D. latifolium*.

### Characters of the Genus

There has been much discussion on the status of the genus *Diplazium* and on its relationship to *Athyrium*. I do not feel that I can offer any new evidence, more especially as the typical species of *Athyrium* (in the stricter sense) occur outside Malaya. In view of Christensen's remarks in this Bulletin, Vol. 7, p. 268, and in view of the fact that in Malaya *Diplazium* and *Athyrium* are quite distinct, I here maintain the genus *Diplazium*, as in Christensen's *Index Filicum*.

The principal characters of the genus may be summarized as follows:—

Stock usually short, erect, sometimes forming a short trunk, in a few cases creeping, but (in Malayan species) the fronds always tufted; roots rather coarse, black, sometimes forming a very close mat on the surface of the ground. Scales on young fronds orbicular to linear, edges entire or toothed, the cells usually elongated, walls of rather uniform thickness, colour throughout medium to dark brown (never clathrate), the teeth where present always formed of two adjacent cells, the ends of which may separate; edges of scales also provided sometimes with short glandular hairs. Stipes relatively stout, sometimes bearing papillae or spines near the base or throughout, these prominences being the bases of fallen scales. Rachises glabrescent, minutely scaly or in a few species hairy on the rounded lower side, papillate in the grooved upper side. Midribs of pinnae and pinnules grooved above, the edges of the groove often strongly winged, the wing often interrupted and/or extended at the junction of the midrib of a pinnule or the main vein of a lobe. Lamina simple, pinnate or bipinnate, texture mostly thin, pinnae and pinnules of bipinnate fronds with subequal base, the venation never anadromous. Veins in most species free, in a few species adjacent vein-groups anastomosing more or less freely. Sori elongated along the veins, with lateral indusium; the lowest acroscopic sorus in any group usually double (diplazoid), and occasionally other sori double also; double sori usually with two quite separate indusia, never grading into a horse-shoe shape with indusium continuous all round.

As compared with the above description, most species of *Athyrium* have an anadromous venation and division,

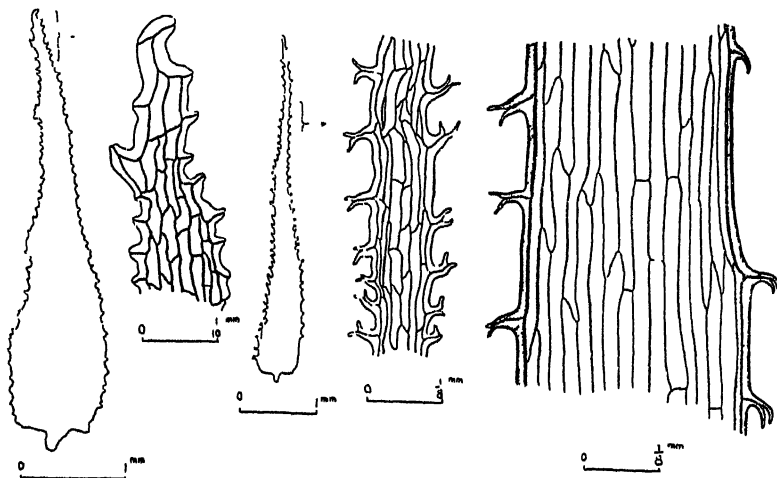


Fig. 1. Scales from base of stipe. On left, *D. crenatoserratum*, outline of single scale and apex enlarged. Centre, *D. silvaticum*, same, showing forked teeth. On right, *D. accedens*, middle part of scale; shaded cells at edges are black.

the pinnules often with very unequal bases, the scales are always relatively broad and entire, usually rather pale and thin, and the sori are always short and broad, the diplazioid ones often of a horse-shoe shape, the two sides of the sorus being connected.

In the character of grooved upper surface of costa and costules and the winged margins of the groove, both *Diplazium* and *Athyrium* agree with *Eu-Dryopteris* and *Polystichum* rather than with *Thelypteris*; and the teeth on the scales on certain species of *Diplazium* are similar in structure to the teeth of *Dryopteris* and *Polystichum*. No scales in *Athyrium* or *Diplazium* (so far as I have observed) have hairs on the margin as found in many species of *Thelypteris* and *Cyclosorus*.

The markedly anadromous leaf-architecture found in many species of *Athyrium* is matched in the group of species formerly called *Polystichum* but now separated by Ching as *Rumohra*. Such leaf-architecture does not occur in *Thelypteris*.

It appears therefore that *Athyrium* and *Diplazium* are more nearly related to *Eu-Dryopteris* than to *Thelypteris*.

Though the leaf-architecture in many species of *Athyrium* is anadromous, there are clearly catadromous species (*e.g.* *A. silvaticum*) commonly referred to that genus. It seems possible that the type of leaf-architecture may afford a useful character in subdividing the genus.

The true *Athyriums* in the Malayan region are all species of rather high mountains (which is probably the reason why they are little represented in Malaya, which has much less high land than the great Sunda Islands), whereas species of *Diplazium*, as noted above, are characteristic of lowlands and medium elevations in the mountains.

### Key to the Species of *Diplazium* of Malaya

*N.B.*—This Key applies only to full-grown plants.  
Fronds simple.

Fronds to 4 cm. wide, narrow at base .. *D. subserratum*

Fronds more than 4 cm. wide, broadly cordate at base .. *D. cordifolium*

Fronds simply pinnate.

Scales entire, not toothed

Veins anastomosing copiously

veins anastomosing near costa *D. heterophlebium*

veins anastomosing only in marginal third of lamina .. *D. cordifolium*

Veins free or only slightly anastomosing

fronds to about 15 cm. wide,  
costæ hairy beneath ..

*D. tomentosum*

fronds usually wider, costæ not  
hairy beneath

pinnæ cut half way or  
more to costa

sori impressed, rachis  
fibrillose, veinlets to  
10 pairs ..

*D. sorzogonense*

sori not impressed,  
rachis not fibrillose,  
veinlets to 7 pairs

*D. malaccense*

pinnæ cut less than half  
way to costa

pinnæ to 5 cm. or  
more wide

veins at 45° to  
costa, pinnæ to 12  
pairs ..

*D. xiphophyllum*

veins at more than  
60° to costa, pin-  
næ to 5 pairs ..

*D. riparium*

pinnæ under 5 cm.  
wide

lower veinlet of  
group simple or  
once forked ..

*D. montanum*

lower veinlet more  
copiously branch-  
ed

2 veins of each  
group sori-  
ferous ..

*D. subintegrum*

4-6 veins of  
each group  
soriiferous

*D. Prescottianum*

Scales toothed

Veins much anastomosing ..

*D. accedens*

Veins free or only occasionally  
joining near margin

pinnæ subentire, more than  
2 cm. wide ..

*D. bantamense*

pinnæ lobed, or if entire, less  
than 2 cm. wide

pinnæ lobed  $\frac{3}{4}$  or more  
towards costa ..

*D. speciosum*

- pinnæ lobed less than  $\frac{3}{4}$   
towards costa  
pinnæ thin in texture, not auriculate below, scales strongly toothed .. *D. silvaticum*  
pinnæ thicker in texture, often auriculate below, scales irregularly and shortly toothed .. *D. crenatoserratum*

# Fronds bipinnate.

## Veins anastomosing

- stipes smooth, pinnules usually less than 2 cm. wide, lobed about  $\frac{1}{4}$  to costa .. *D. esculentum*  
stipes spiny, pinnules always more than 2 cm. wide, toothed only .. .. *D. insigne*

## Veins free

- scales  $\pm$  round, peltate, entire  
sori very short, basal on veins .. *D. latisquamatum*  
sori longer, medial on veins .. *D. Kunstleri*  
scales much longer than broad  
frond to about 30 cm. long .. *D. velutinum*  
frond much longer  
lobes of pinnules 3-4 mm. wide, cut more than  $\frac{3}{4}$  to midrib .. *D. polypodioides*  
lobes of pinnules 7 mm. or more wide, cut less than  $\frac{3}{4}$  to midrib  
rhizome procumbent, fronds to 80 cm. long .. *D. procumbens*  
rhizome erect, fronds to more than 100 cm. long  
lower pinnules sessile, to c. 2 cm. wide, veins to 5 pairs, all simple .. *D. simplicivenium*  
lower pinnules on stalks to 5 mm. long, to more than 2 cm. wide, veins 5-8 pairs, some forking .. *D. dilatatum*

1. *Diplazium accedens* Bl. Enum. 192. 1828.

Stock stout erect, sometimes a short trunk. *Stipes* stout, green, covered with soft green protuberances near base, to c 60 cm. long; when young covered with narrow scales, each on the end of a protuberance, the scales to 15 mm. wide at base, dull brown, thick in texture, with narrow black toothed edge (see fig. 1). *Lamina* simply pinnate, to 120 cm. or more long and 50 cm. wide, pinnæ about 15-jugate; apex of frond like the lateral pinnæ or with 1 or 2 deep lobes at the base; rachises and costæ glabrescent, smooth, buds common in the axils of the pinnæ. Lower pinnæ on stalks to 8 mm. long, upper sessile, gradually smaller. *Largest pinnæ* to  $40 \times 8$  cm., base truncate or very broadly cuneate, sides parallel for  $2/3$  or more of the length of the pinnæ, then tapering to acute apex, *edges entire or very shallowly lobed*, the lobes slightly toothed. Main lateral veins in the pinnæ about 8-12 mm. apart on the costa, at about  $60^\circ$  to the costa, each bearing up to 10 pairs of lateral veinlets, the lateral veinlets of adjacent groups anastomosing when they meet and so producing a series of parallelogram-shaped areolæ; anastomosis of small veins near edge of lamina irregular. Sori on some or all the veinlets, often throughout their length.

A fern of shady mountain stream-sides found in Malaya only on the Main Range and Taiping Hills. Sometimes in very large fronds there are extra areoles between the normal groups adjacent to the main lateral veins; a specimen having this character formed the basis of *Athyrium Ridleyi* Copeland, which I include in the present species.

This species is closely related to *D. proliferum* (Lam.) Thouars, and the two should perhaps be united; if so, the species in this broader sense would extend from the Mascarene Islands to the Pacific. A study based on material from all parts of this wide range is required to decide on the status of *D. accedens* and *D. proliferum*.

As regards the name *D. accedens*, the situation is a little complicated. It appears that the three names *D. accedens*, *D. repandum* and *D. Swartzii*, all published in the same book by Blume, are to be regarded as synonymous. Later authors have in many cases regarded all as synonyms of Lamarck's earlier name, or of *Asplenium decussatum* Sw.; the names *Swartzii* and *accedens* have been taken up and used in the genera *Callipteris*, *Asplenium* and *Athyrium*, but the name *D. repandum* appears to have been almost or entirely ignored. Backer and Posthumus (1939), however, have revived the name *D. repandum*, apparently on grounds of page priority (though they do not state this) which is not admitted by the Rules. In their synonymy, however,

they include *Diplazium proliferum* Thouars, an older name; their use of the name *D. repandum* is therefore contrary to the rules.

It appears to me that, if the Malaysian fern is to be regarded as specifically distinct from that of the Mascarene Islands, the name *Diplazium accedens* Bl. is the appropriate one to use, as this name has already been used by Christensen in the 3rd Supplement to his *Index Filicum* (1934), and had previously been used in a varietal sense for Java ferns by van Alderwerelt van Rosenburgh.

## 2. *Diplazium bantamense* Bl. Enum. 191. 1828.

Stock short suberect. Stipes to 60 cm. long, glabrescent, clothed at the base with brown scales about 1 cm. long and 1.5 mm. wide at base, edges finely toothed. Frond simply pinnate, to about 60 cm. long and 25 cm. wide, pinnæ up to about 8 pairs, terminal pinnæ similar to the others or occasionally with a large lobe at the base; a bud often present on the rachis at the base of one of the upper pinnæ. Basal pinnæ on stalks 3 mm. long, base slightly unequal, on the lower side rounded and on the upper side cuneate at 45° and decurrent; bases of the upper pinnæ more equally rounded. Sub-basal pinnæ largest, up to about 20 by 7 cm., commonly about 12 by 4.5 cm., widest a little above the base, then narrowed gradually to the acuminate apex; edges entire or toothed only near the apex, texture firm; veins usually distinct on both surfaces but sometimes obscure, at rather more than 45° to the costa, forked at or near the costa, the upper branch simple and often soriferous almost throughout its length (diplazioid sorus), the lower branch forked again 1-3 times, 1-3 of the branches often bearing short simple sori towards the margin; occasionally a slight anastomosis of veins towards the margin; indusia narrow, persistent.

Young plants have fronds with simple lamina to about 15 by 5 cm., deeply cordate or almost sagittate at the base, later fronds having one or more pairs of lateral pinnæ below the terminal lamina. This behaviour is closely similar to that of *D. cordifolium*; but *D. cordifolium* develops a much larger simple lamina, which usually becomes fertile, before producing fronds with free lateral pinnæ.

The name *D. bantamense* has in the past been given to all Peninsular specimens of *Diplazium* with free veins and rather broad subentire pinnæ. These I now separate into *D. bantamense* with toothed scales, *D. xiphophyllum* and *D. riparium* with entire scales. I find that *D. bantamense* as above described agrees well with Java specimens, and hence, though I have not seen the type, I feel confident that I have selected the correct Peninsula

fern to bear this name. It is a fern of moist shady forest, chiefly in the hills, sometimes near streams in lowland forest. In the shape of its pinnæ, it most nearly resembles the pinnate form of *D. cordifolium*, but the much anastomosing veins of the latter distinguish it.

Specimens in Singapore Herbarium:—

TRENGGANU. Kuala Berang, on streambank, Holttum s.n., 11.5.1925.

PAHANG. Fraser's Hill, 4,000 ft., S.F.N. 10018 (Holttum & Burkill); S.F.N. 11473 (Holttum); S.F.N. 36505 (Holttum). Cameron Highlands, Robinson Falls, 4500 ft., S.F.N. 17978 (Henderson); 4,800 ft., S.F.N., 23340 (Holttum). Sungei Teku, 500 ft., S.F.N. 20554 (Holttum).

PERAK. Waterloo, Curtis 1361 p.p. (narrow toothed pinnæ, and apical pinna lobed; a doubtful specimen). Ulu Temango, Ridley 14229. Taiping, 300–500 ft., King's Collector 8388. Upper Perak, 300 ft., Wray 3616.

NEGRI SEMBILAN. Ulu Bendul, S.F.N. 9876 (Holttum).

SELANGOR, near the Gap, 2,700 ft., S.F.N. 37159 (Addison).

PENANG, near Tiger Hill, 2,500 ft., S.F.N. 19346 (Holttum).

### 3. *D. cordifolium* Bl. Enum. 190. 1828.

Stock short erect. Stipes to 50 cm. or more long, clothed at the base with brown scales about 1.0 cm. long and 1.5 mm. wide at base, edges of scales entire. Fronds of two kinds, either simple with cordate base, or pinnate with ovate entire pinnæ; transition forms also occur, but fully-grown plants may bear simple fronds. Lamina of simple fronds to 35 cm. long and 12 cm. wide, the base cordate (often with a bud on the costa close to the base) the apex more or less acuminate, the margin entire; texture thin but firm, veins clearly visible on both surfaces; veins at more than 60° to the midrib, forked close to the midrib, the lower branch forked again, lateral members of the groups so formed anastomosing about half-way towards the margin, the outer part of the lamina containing a series of narrow areoles about 1 mm. wide and 1 cm. or more long. Sori on the outer veins of each group and also on some of the inner veins, anastomosing with the veins, and reaching almost to the edge of the lamina; indusia narrow, persistent. Pinnate fronds with 1–8 pairs of pinnæ below the terminal lamina, which is smaller as the number of lateral pinnæ increases. Lateral pinnæ sessile or the lowest very shortly stalked, varying much in size, the basal pinnæ largest, upper ones

gradually smaller; base of pinnæ subequally rounded, margins quite entire, apex shortly acuminate; largest pinnæ usually 12–16 cm. long and from 2.5 to 6.5 cm. wide; veins as in the simple lamina above-described, but more oblique to the midrib of the pinnæ (at about 15°).

This species is frequent in both lowland and mountain forest in Malaya but is never found in the open. In the lowlands it rarely (if ever) develops beyond the stage of simple fronds, and in the mountains it appears that some plants remain for a considerable time at this stage, which is usually fully fertile. It is common, however, in mountain forest to find plants which have one or more pairs of lateral pinnæ below the cordate terminal lamina, and all stages of transition can be found up to fronds with 7 or 8 pairs of lateral pinnæ. Specimens of the latter have usually been named *D. fraxinifolium* Pr. or *D. lineolatum* Bl., simple fronds being called *D. cordifolium*.

Backer and Posthumus (*Varenflora voor Java*, p. 123), recognizing that both simple and pinnate forms belong to one species, use the name *D. fraxinifolium* Presl. Presl's name was published prior to *D. cordifolium*, but the description is very inadequate (anastomosis of veins is not even mentioned) and I think it better to use Blume's name, which is well established. Owing to the polymorphism of this species, and to the superficial resemblance of pinnate forms to *D. bantamense* Bl., there has been much confusion of names.

The parallel between *D. bantamense* and *D. cordifolium* is a close one. Both ferns have at first simple fronds, and later one or more pairs of lateral pinnæ which are broad and sub-entire. There are, however, several clear differences. The scales are toothed in *D. bantamense* and entire in *D. cordifolium*; the veins are almost always quite free in *D. bantamense* but copiously anastomosing in *D. cordifolium*; and the initial stage of simple lamina is much more developed in *D. cordifolium*, being often fertile, whereas the simple lamina of *D. bantamense* is only found in young plants and is rarely fertile.

I think it unnecessary to cite the many specimens of this species which have been obtained in all parts of Malaya.

4. *D. crenatoserratum* (Bl.) Moore, Index 121. 1859.  
Asplenium Bl. Enum. 177. 1828.

Stock short, erect. Scales on young fronds and bases of stipes to about 4 by 1.5 mm., acuminate, edges irregularly and shortly toothed, teeth not forked (see fig. 1). Stipes to about 30 cm. long. Fronds simply pinnate, commonly about 30 cm. by 15 cm., sometimes larger, pinnæ numerous, close, the upper adnate, grading into the lobed deltoid apical

lamina, the lower longest, on stalks to 5 mm. long, commonly about 15 by 2 cm., sometimes larger, texture firm. *Pinna* of fronds on young plants with bluntly rounded apex, edges almost entire, base truncate and slightly auricled above. *Pinna* on large plants acuminate, edges lobed  $\frac{1}{4}$ – $\frac{1}{2}$  way towards costa, base strongly auricled above and less so below; lobes close, usually irregular in length; veins pinnate in the lobes, to about 4 pairs, often all fertile, the sori from the costa almost to the edges, the sorus on the lowest acroscopic vein diplaziod, the others not.

This is a very common fern of lowland forest, varying much in size and in the degree of lobing of its pinnæ. Young (or small) plants with blunt entire pinnæ may be fertile. The largest plants approach *D. silvaticum*, but differ in the points mentioned under that species. It approaches also *D. tomentosum*, some specimens having many short hairs, like those of *D. tomentosum*, on the base of pinna-stalks beneath, and to much less extent on the main rachis; but *D. crenatoserratum* is never so tomentose as typical *D. tomentosum*. Typical specimens of the two species are very different, but some are almost intermediate; distinguishing characters are given under *D. tomentosum*.

#### 5. *Diplazium dilatatum* Bl. Enum. 194. 1828.

A very large fern, with stout erect stock. *Stipes* 8 mm. or more in thickness near base, slightly rough with raised bases of fallen scales; scales to about 1.5 cm. long, hardly 1 mm. wide at base, brown with black toothed edges. *Lamina* bipinnate-tripinnatifid, pinnæ to 75 cm. long and 27 cm. wide, pinnules to about 12-jugate below deltoid lobed apex of pinna. Rachis glabrescent, costæ with scattered very narrow brown scales, especially near base and on stalks of pinnules. Largest pinnules to 18 by 4 cm. (commonly narrower) on stalks 5 mm. long, base truncate-subcordate, apex acuminate, cut half-way to costa or a little more, segments 8–10 mm. wide at base, slightly oblique, edges slightly toothed, apex rounded; smaller distal pinnules sessile, lobed less deeply; texture thin but firm, colour when dry dark. Veins in each lobe pinnate with 5–8 pairs of veinlets, lowest acroscopic veinlet often simple, the rest usually forked (sometimes simple in fronds of small or young plants), sori from near base along  $\frac{1}{2}$ – $\frac{2}{3}$  length of the veinlets; sorus on basal acroscopic veinlet usually diplaziod, rest not.

This very fine species has only been found in Malaya at Cameron Highlands. The Highlands specimens closely match a fern from Java (G. Ardjœnœ, 1800 m. Posthumus 3939) and also the Sumatran specimens quoted below. I

think they are quite distinct from the more numerous specimens, mostly from lower elevations, referred in this paper to *D. simplicivenium*.

Specimens in Singapore Herbarium:

PAHANG. Cameron Highlands, 1,600 ft., S.F.N. 23620 (Henderson); S. Terla, 3,900 ft., S.F.N. 31334 (Holtum), young plant.

SIAM. Doi Chiang Dao, Eryl Smith 1198.

SUMATRA. Brastagi, 5,000 ft. S.F.N. 15103 (Holtum). Dolok Singgalang, N. v. h. Tobameer 1650 m., Lorzing 8864.

Copeland Pterid. Philip. Exsicc. 178 (Mt. Matutum, April 1917) seems to me closely similar to the above specimens and I would refer it to the same species.

6. *Diplazium esculentum* (Retz.) Sw. Schrad. Journ. 1801, 2: 312. 1803. *Hemionitis esculenta* Retz. Obs. Bot. 38. 1791.

Stock erect. Stipes to 50 cm. or more long, glabrescent except for a few brown scales at base; scales about 1 cm. long and 1 mm. wide, the edges finely toothed. *Lamina bipinnate, large*, often 1 m. or more long and about half as wide. Pinnæ to 50 cm. or more long, bearing numerous pinnules which are often rather distant from each other. *Pinnules varying much in size and cutting, usually less than 2 cm. wide*, the lowest stalked 2 mm., the rest sessile, *truncate or broadly cuneate and usually more or less auricled on one or both sides at the base, edges crenate or lobed up to about 1/4 distance to costa*, the lobes or crenations slightly toothed. Veins in pinnate groups in the lobes, about 8-10 pairs of side veins, *the lower 2-3 pairs of adjacent groups anastomosing*, forming an irregular intermediate excurrent vein leading towards a sinus between adjacent lobes. Texture thin; rachises and costæ glabrescent, or occasionally pubescent beneath with numerous pale brown hairs with dark cross-walls, and scattered or abundant small ovate toothed scales on costæ. Sori occupying almost the whole length of the veins, often also on part of the joint excurrent vein, often more than one diplazioid sorus in each group.

This is a common fern of wet ground in open places in the lowlands of Malaya, and is well known as an edible plant. It never occurs in shady forest. It is a straggling and untidy species, lacking the beauty of most of the larger species of this genus.

The excurrent vein formed by union of the lateral veins of adjacent groups does not run to the sinus, stopping there in a thickened single unit, as in *Cyclosorus* (*Dryopteris* p.p.), but divides just below the sinus, part running close

to the edge of the lamina on either side above the sinus. Thus, though the venation of *D. esculentum* is superficially similar to that of species of *Cyclosorus*, it is not identical and doubtless had a quite separate origin.

7. **Diplazium heterophlebium** (Mett.) Diels Nat. Pil. 1, 4: 228. 1899. *Asplenium heterophlebium* Mett.; Baker, Syn. Fil. 243. 1867.

Stock short erect. Stipes slender, to 30 cm. long, glabrescent, when young clothed at the base with *thin entire brown scales* to about 1 cm. long and 15 mm. wide at the base. *Lamina to at least 35 cm. long and 25 cm. wide, the apical part* (in young plants the whole lamina) *deeply lobed, and below this a few pairs of adnate or sessile pinnæ*. Lobes of apical lamina falcate acuminate entire, to about 15 cm. long and 4 cm. wide; pinnæ to about the same size, their edges entire or more or less deeply undulate. Main lateral veins in the pinnæ pinnate, *the veinlets of adjacent groups anastomosing rather irregularly from about 1/4 distance from costa to margin*, the areolæ smaller towards the margin, with free short veins with thickened ends just within the margin. Sori of small fronds few, often one to each vein-group, on the basal areoscopic vein, often all simple but sometimes diplazioid; on larger fronds often several sori to each vein-group, some of them anastomosing with the veins. Texture thin, rachis and costæ glabrous or slightly scaly beneath with small narrow entire scales.

In Malaya, this species has only been found in the valley of the Bertam River, below Cameron Highlands, at 3,000–3,500 ft. altitude. The specimens there gathered differ from Himalayan specimens in having broader fewer pinnæ, all (or almost all) adnate to the rachis, with ampler venation and more irregular anastomosis. It is possible that fully grown plants have not yet been noticed. Further collecting in the valleys in the north of the main range will no doubt reveal more localities for this and other ferns of northern distribution which find their southern limit in Malaya. The thin pale entire scales show that this species is not closely related to *D. accedens*, though the anastomosing venation might lead one to think them allied.

8. **Diplazium insigne** Holttum, Gard. Bull., S.S., 9: 123. 1937.

Stock stout, short, erect. Stipes stout, c. 1 m. long, spiny towards the base, the spines 2 mm. long, each at first bearing a scale; scales dull brown 15 cm. long by 1.5 cm. wide at the base, with a narrow black toothed edge, deciduous. *Lamina to 1.5 m. long, bipinnate*. Lowest pinnæ about 28 cm. long and 6.5 cm. wide, narrowed and

stalked at the base, the margins lobed half-way to the costa, the apex acuminate. *Middle pinnæ* largest, to 60 cm. long and 16 cm. wide, pinnate; pinnules slightly oblique, adnate to the rachis (the lowest ones narrowly, the upper fully adnate and grading into the lobed apical lamina of the pinna), to 9 cm. long and 2.3 cm. wide, cuneate at the base at an angle of about 45° on each side, narrowed gradually from the base and then suddenly at 1.5–2 cm. from the apex, margins slightly serrate; texture firmly herbaceous; veins anastomosing as in *D. accedens*. Sori few or copious, the lowest acroscopic sorus in each vein-group usually diplazioid, and occasionally a few others also.

This species is evidently closely allied to *D. accedens*, and the apex of a frond might pass for that species, but its copious bipinnate form marks it as a quite distinct species. It is evidently similar to *D. Smithianum* from Ceylon, but appears to be much larger; probably both *D. Smithianum* and *D. insigne* are local derivatives of *D. accedens* (or *D. proliferum*).

Since the original description of *D. insigne* was published, I have discovered a collection made by Curtis on Taiping Hills at 2,000 ft. (No. 1352), labelled *D. Smithianum*, which is clearly *D. insigne*. Otherwise no new locality has yet been found for *D. insigne* except the type locality in a valley below Fraser's Hill (Pahang side).

#### 9. *Diplazium Kunstleri* Holttum sp. nov. Fig. 2.

Rhizoma repens? Stipites ad 1 m. longi vel ultra, in sicco olivaceo-straminei, non muricati, basin versus squamis rotundatis peltatis deciduis muniti. Rachides læves, pallidæ, plerumque ad basin pinnarum superiorum proliferæ. Lamina bipinnata, ad 120 cm. longa et 80 cm. lata vel ultra; pinnæ fere 12–jugatæ, infimæ leviter reductæ, superiores in lobos apicis laminæ sensim mutatæ. Pinna maximæ c. 65 cm. longæ, c. 25 cm. latæ, in stipitibus 9 cm. longis stantes (stipites pinnarum superiorum sensim breviores). Pinnulæ infimæ inter se 5 cm. distant; pinnulæ maximæ 16 cm. longæ et 3.5 cm. latæ, stipitatæ 3 mm. vel ultra (ad 8 mm.), basi late cuneatæ vel truncatæ, apici acuminatæ dentatæ, cetera margine lobatæ 2/3 costam versus; lobi leviter obliqui, 5–7 mm. lati, basi dilatati, margine leviter serrati, apice rotundati; costulæ falcatæ, squamis parvis latis peltatis paucis munitæ; venulæ in uno lobo 7–9–jugatæ, obliquæ, plerumque furcatæ (vel in pinnulis parvis simplices), utrinque distinctæ sed haud prominentes; lamina textura quam species affines crassior. Sori medium venularum solum occupantes; indusia angusta, in soris maturis haud evidentia.

TYPUS: Ginting Simpah, Selangor, 2,500 ft. alt., S.F.N. 31194, leg. Holttum.

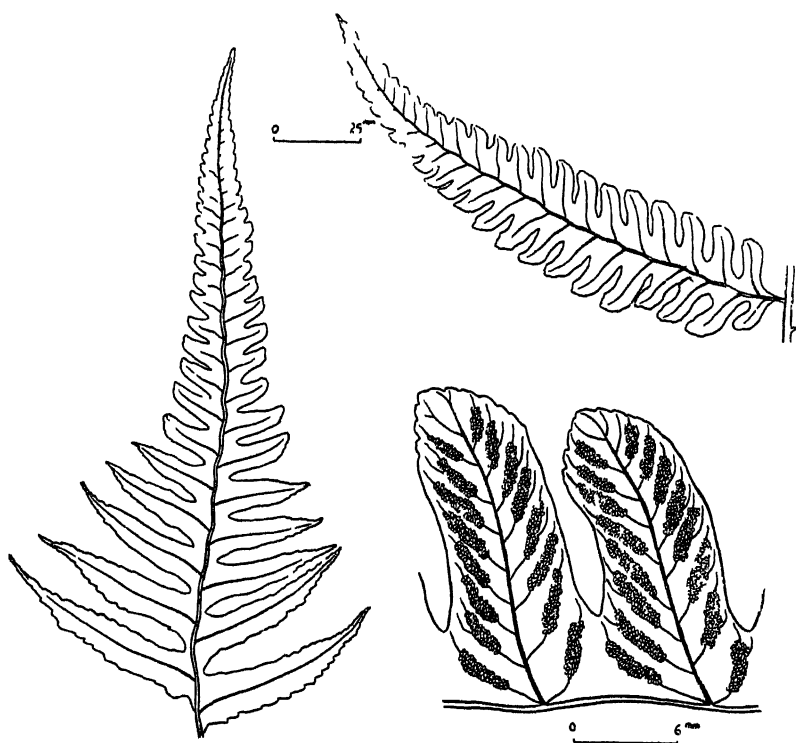


Fig. 2. *Diplazium kunstleri*, type. On left, apex of frond; on right, above, single pinnule from middle pinna; below, two fertile lobes.

*D. Kunstleri* is very distinct among the Malayan bipinnate species of *Diplazium* in the combination of the following characters: round peltate scales (otherwise found only in *D. latisquamatum*); pinnules cut more than half-way to the costa, with broad lobes; medial sori which never reach base or apex of the veins; and proliferous rachis. I found the type growing in a rocky streambed in shady forest.

The species is named after Hermann Kunstler ("King's Collector" of herbarium labels), who collected many interesting Malayan plants for the first time. He collected *D. Kunstleri* "near little stream, dense jungle", near Ulu Kerling, under No. 8797. Other collections in the Singapore herbarium are: 15th mile, Pahang Track, Ridley 8652; Rawang, Ridley 7843, 7852. Thus all specimens have been found on the Main Range in Selangor, at medium altitudes.

10. *Diplazium latisquamatum* Holtt. Gard. Bull., S.S., 9: 124. 1937. Fig. 3.

Stock short erect. *Stipes* to 90 cm. long, throughout or towards base only papillate with rather soft green papillæ, which in young fronds bear round or ovate, peltate, entire, nearly black scales, to about 5 mm. long and 3 mm. wide; old stipes and rachises bearing scattered small rounded scales only. *Lamina* to about 15 m. long and 1 m. wide, bipinnate-tripinnatifid. Largest pinna to about 60 cm. long and 23 cm. wide, shortly stalked, the basal pinnules slightly reduced, smaller on the acroscopic than on the basiscopic side. *Pinnules sessile* (or the basal ones on stalks to 2 mm. long), the largest about  $12 \times 2.5$  cm. (commonly about  $9 \times 1.5$  cm.), base broadly cuneate or subtruncate, gradually narrowed to acuminate toothed apex, margins lobed to within 2-3 mm. of the costa, lobes slightly oblique, mostly about 4 mm. wide, apex truncate, margins entire or slightly toothed near apex, texture thin but firm, costæ bearing scattered small ovate or rounded scales; veins pinnate in the lobes, the veinlets 5-6-jugate, simple or forked. *Sori* occupying only the lower half or less of the veins, the basal acroscopic sorus usually diplazioid, the others simple, the indusia thin, broad, persistent.

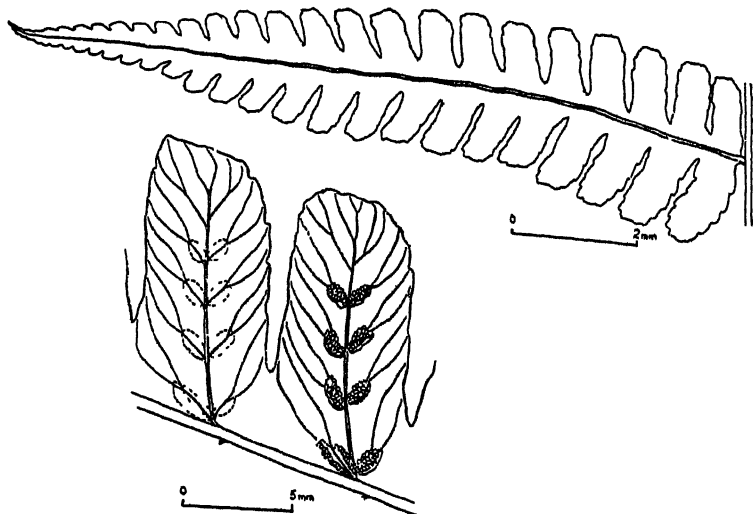


Fig. 3. *Diplazium latisquamatum*. Above, single pinnule from middle pinna. Below, two fertile lobes; the dotted outlines on the left hand lobe show the position of sori removed.

This species is very clearly distinguished from all others in Malaya by its almost round peltate entire scales and very short sori confined to the basal half of the veins. In general appearance, it resembles *D. procumbens*, but the scales of the latter, and its prostrate stem, distinguish it, even in sterile plants.

*D. latisquamatum* has been found in Malaya in shady forest by streams in the valleys of the Main Range at 1,000–5,000 ft. at Cameron Highlands and Fraser's Hill only. I have collected closely similar specimens in Sumatra, at 6,000–7,000 ft. altitude on Korinchi Peak. I am, however, in some doubt whether the Kinabalu (British North Borneo) specimens cited with the original description of the species should be regarded as identical; some have decidedly longer and more pointed scales, and pinnæ and pinnules broader.

The additional specimens from Malaya and Sumatra to be added to the list published in 1937 are:—

PAHANG. Fraser's Hill, 4,000 ft. S.F.N. 11007 (Md. Nur); S.F.N. 36504 (Holtum).

SUMATRA. Korinchi Peak 6,000–7,000 ft., Holtum s.n. 13/2/1933.

# 11. *Diplazium malaccense* Presl. Epim. Bot.: 86, 1849

Stock short erect. *Stipes* to c. 50 cm. long, clothed at base with entire brown scales which are 10–15 mm. long and 1.5–2 mm. wide at base, rest of stipe and rachis glabrescent, not fibrillose. *Lamina* pinnate, to about 60 by 30 cm. Pinnæ to about 20–jugate, below lobed apex of the lamina. Lower pinnæ on stalks 5 mm. long, bases very unequal, lower base often much cut away, upper truncate; upper pinnæ with base subequally truncate or broadly cuneate. Pinnæ thin in texture, drying rather light green, commonly to 16 cm. long and 2 cm. wide, apex acuminate, lobed not more than 2/3 way to the costa, lobes about 6 mm. wide at the base, a little more oblique than in *D. sorzogonense*, ends rounded to subtruncate and slightly toothed; veins up to 7 pairs in each lobe, all simple; sori from near base of veins to near margin of lamina, the acroscopic basal sorus usually but not always diplazioid. Surface not depressed below sori; indusium medium brown, thin but firm, usually turned back but not rolled as in *D. sorzogonense*.

A species of lowland and midmountain forest, found throughout Malaya, differing from *D. sorzogonense* (which grows in similar localities) in glabrescent stipe and rachis, less deeply lobed pinnæ, and sori not at all impressed. Specimens have been distributed under the names *D. silvaticum* and *D. speciosum*, both of which differ in having toothed scales.

A very large, perhaps monstrous, specimen was gathered by Mohamed Nur on Gunong Angsi (S.F.N. 11563). The apical part of the frond is quite like normal *D. malaccense*, but the middle and lower pinnæ are very large (to 8 cm. wide) and deeply lobed (almost to the costa), the lobes being falcate and acutely pointed, with forked lateral veinlets up to about 20 pairs. The bases of these pinnæ have 3 or 4 pairs of normal segments below the larger pointed segments.

**12. *Diplazium montanum* v.A.v.R. Bull. Buitenz. II Ser., 28: 19. 1918.**

Stock short erect. Scales on bases of stipes narrow, black, entire, to about 10 by 1 mm. Stipes black at the base, to about 60 cm. long. Frond simply pinnate. Pinnæ to about 20—jugate, to about 18 by 2 cm., the lower ones on stalks to 4 mm. long, upper sessile, the apical pinna like the others (occasionally with one or two  $\pm$  separate round lobes at the base); upper pinnæ unequally cuncate at the base; lower pinnæ with upper base narrowly rounded, lower base narrowly cuneate; edges of pinnæ toothed, apex acuminate toothed, texture thin; veins forked at or near base, the acroscopic branch soriferous, simple, the lower branch simple or sometimes forked, occasionally bearing a short sorus. Sori on the acroscopic veinlet mostly simple, but occasionally diplazioid, reaching from the costa almost to the edge of the lamina.

This species differs from *D. pallidum* Bl. in having the apical pinna like the others (in *D. pallidum* the apical lamina of the frond is deltoid and deeply lobed), and in having the lower pinnæ with much narrower bases (in *D. pallidum* the lower pinnæ have a broadly truncate upper base). It appears also that *D. pallidum* has fertile fronds from a young stage of development, whereas *D. montanum* does not produce fertile fronds until the plants are full grown.

*D. pallidum* occurs in Sumatra on the higher parts of the mountains, matching Java specimens exactly; *D. montanum* appears to occur at lower levels in Sumatra, thus falsifying its name. In the Peninsula *D. pallidum* does not occur. *D. montanum* occurs in forest at low and medium elevations.

Specimens in Singapore Herbarium:—

PAHANG. Tahan River, Ridley 2167. Tembeling, S.F.N. 24703 (Holtum). Buloh Telang, P. Tioman, 800 ft., S.F.N. 18583 (Henderson).

PERAK. 2,000–2,500 ft., King's Collector 10959. Sungei Siput, Haniff 4047. Ulu Temango, Ridley 14209.

SUNGEI UJONG. Hüllett s.n. Aug. 1880.

SELANGOR. Batu Caves, Ridley 8139.

SUMATRA (East Coast). Region of Marban, Bilah, near Bilah Pertama. Rahmat si Torocs 115,221 (distr. Univ. of Michigan).

SIAM. Palani, 210-350 m., on rock in stream, Eryl Smith 1918.

13. **Diplazium polypodioides** Bl. Enum. 194. 1828.

*D. asperum* Bl. Enum. 195. 1828.

Stock stout, erect, often subarborescent; stipes stout, to 1 m. long, clothed thickly at the base with *narrow scales of thick texture, dull brown with narrow black toothed edges*, to about 4 cm. long and 2 mm. wide at base, usually not more than 1 mm. wide over the greater part of their length; *the scales attached to protuberances on the stipe which remain as more or less short prickles up to 1 mm. or rather more in height.* Lamina bipinnate, deeply tripinnatifid, commonly about 100 cm. long and 60 cm. wide, sometimes much larger, largest pinnæ to about 85 by 30 cm., commonly less, shortly stalked, with 20-30 pairs of pinnules below the deltoid lobed apex of the pinna. Largest pinnules to 16 by 3.5 cm., commonly about 9 by 2 cm. or sometimes less, sessile or the lowest shortly stalked, base truncate or very broadly cuncate, apex acuminate, *edges cut into lobes  $\frac{3}{4}$  or more towards the costa*; lobes slightly oblique, subtruncate or bluntly pointed, their margins *sharply toothed throughout, 2-5 mm. wide*, veins 7-12 pairs in each lobe, usually simple, forked in the largest lobes; texture thin to firm. Rachises and costæ usually glabrescent, the costæ sometimes with small narrow scales; rachises, like the stipes, often slightly prickly with the bases of fallen scales. Costæ above distinctly winged, the wing interrupted and sometimes dilated at the base of each costule. Sori usually present on almost all veins, from the base half-way or more to the edge, the indusia thin but persistent; on short narrow lobes with close veins the sori may be almost confluent.

The long narrow black-edged toothed scales, the usually prickly stipes, and the deeply cut narrow toothed lobes are characteristic of this species.

SELANGOR. Klang Gates, F.D. 14602 (Ingram).

Ginting Simpah, 1,500 ft., Hume 8551B (Herb.

F.M.S. Mus.), S.F.N. 9982 (Burkill).

NEGRI SEMBILAN. G. Angsi 950 ft. S.F.N. 11515

(Md. Nur). Senaling Inas F.R., in small clear-

ing, S.F.N. 9770 (Holttum).

PENANG. N. of Western Hill, 2,000 ft., S.F.N. 19776

(Holttum). Penara Bukit, 2,000 ft., S.F.N.

19342 (Holtum). No loc., abundant, C. Curtis 10135.

PERAK. Ulu Temango, Ridley 14206. Ulu Bubong, King's Collector 10849.

PAHANG. Raub, S.F.N. 14103 (Best). Telom, Ridley 13975. Kuala Tahan, Ridley 2,100. S. Sat, S.F.N. 22089 (Henderson). Robinson Falls, 4,000 ft., S.F.N. 23262 (Holtum). Boh Plantations, 4,000 ft., S.F.N. 32937 (Md. Nur). C. Highlands, 5,000 ft., S.F.N. 23518 (Holtum) S.F.N. 31295 (Holtum); 4,800 ft., S.F.N. 23361 (Holtum).

In Malaya, this species is common by the edge of forest in moist ground, especially by streams, never in the heavy shade of high forest. It is especially characteristic of the mountains between 2,000 ft. and 4,000 ft., occurring abundantly by roadsides, but occurs also in low country and at higher elevations. In very moist slightly shaded situations in mountain valleys it sometimes attains a very large size, with broader and thinner leaflets than commonly, but I cannot see any clear specific distinction between these and the smaller leaves of firmer texture. The upper parts of larger fronds are much like the smaller fronds.

I have not examined any Indian specimens, and I do not know how far the specimens described by Beddome as *D. polypodioides* and *D. asperum* would agree with Malayan plants. *D. polypodioides*, as I understand it, is certainly a very widely distributed species. I have seen specimens which I would so name from N. Siam, Hainan, the Philippines and New Guinea.

As regards the identity of Blume's two species, *D. asperum* and *D. polypodioides*, I follow both Raciborski and the recent work of Backer and Posthumus in uniting them, using the name *polypodioides*, though I think it is a pity that the more appropriate name *asperum* was not chosen. Van Alderwerelt van Rosenburgh suggested various differences between Blume's two species, but I do not find that these differences are constantly associated in Peninsula specimens. As above noted, habitat appears to have a considerable influence on size and other characters.

14. *Diplazium Prescottianum* (Wall.) Moore, Index 156. 1859. *Aspidium Prescottianum* Wallich, Catalogue No. 235 (nomen); Hooker, Spec. Fil. 3: 251. 1860.

The type of this species was collected in Singapore, and agrees with the other Singapore specimens quoted below. These may be described as follows. Scales on bases of stipes brown, entire, about 15 mm. wide at base. Pinnæ to about

14-jugate below the lobed deltoid apex of the lamina, texture firm. *Lowest pinnæ on stalks to 6 mm. long, upper sessile or adnate. Lower pinnæ to 21 cm. long and 1.8 cm. wide, base unequal, rounded above, rounded or cuneate below; upper pinnæ with broadly cuneate auricled upper base, and narrowly cuneate lower base. Edges of pinna crenate or slightly lobed, lobes slightly toothed or entire, the auricle at the base of the upper pinnæ more or less separated by a sinus from the rest of the pinna (in the type with a few similar lobes following it, cut nearly to the costa). Veins of largest pinnæ in pinnate groups, 3-4 veinlets on each side of the main vein, 4-6 veins in each group soriferous, sorus on basal acroscopic vein diplazioid, others not; sori from near base of vein to near margin.*

The other specimens differ in the width of the pinnæ, which are up to 3.3 cm. wide, and some of them in the entire lack of an auricle on the upper base of the upper pinnæ. All agree in the character of the scales, the stalks of lower pinnæ, the slight lobing or crenation of the edges of the pinnæ, and the number of veins and sori in each group. The species appears to be related to *D. montanum* v.A.v.R. (and *D. pallidum* Bl.), but differs in larger brown scales, more lobed edges to pinnæ, and many more soriferous veins in each group. From *D. subintegrum* it differs in shorter pinna-stalks, more lobed edges, more veins and sori in each group.

Specimens in Singapore Herbarium:—

SINGAPORE. Between Bukit Panjang and Woodlands, Matthew; Toas, Ridley s.n. 1892.

SELANGOR. Ginting Simpah, Hume, F.M.S. Mus. 9665, 9347, 8997, 9677.

PERAK. Kinta, 1,500-2,000 ft., Kunstler 7146. Larut, 2,000-3,000 ft., Kunstler 2391. Kinta, Curtis 3369.

SIAM. Patani, 540-700 m., Eryl Smith 1930; 260 m., Eryl Smith 1927. Koh Chang, Marcan 1268.

# 15. *Diplazium procumbens* Holttum sp. nov. Fig. 4.

Rhizoma procumbens, c. 1 cm. diametro. Stipites ad 80 cm. longi, in sicco sordides vel straminei, glabrescentes, basibus squamarum deciduarum leviter asperuli, in juventute squamis parvis lineari-lanceolatis, fuscis, margine leviter dentatis (non nigris) vestiti. Lamina deltoidea, bipinnata, ad c. 80 cm. longa et c. 80 cm. lata; pinnæ maximæ 50 cm. longæ et 20 cm. latæ. Pinnulæ sessiles vel infimis stitipatæ (stipites 3 mm. longi), maximæ 2.5 cm. latæ, basi truncatæ, apice acuminatæ,  $\frac{3}{4}$  ad costam lobatæ; lobi maximi basi 7 mm. lati, oblongi, cum costa angulum fere rectum formantes, apice rotundati, margine apicem

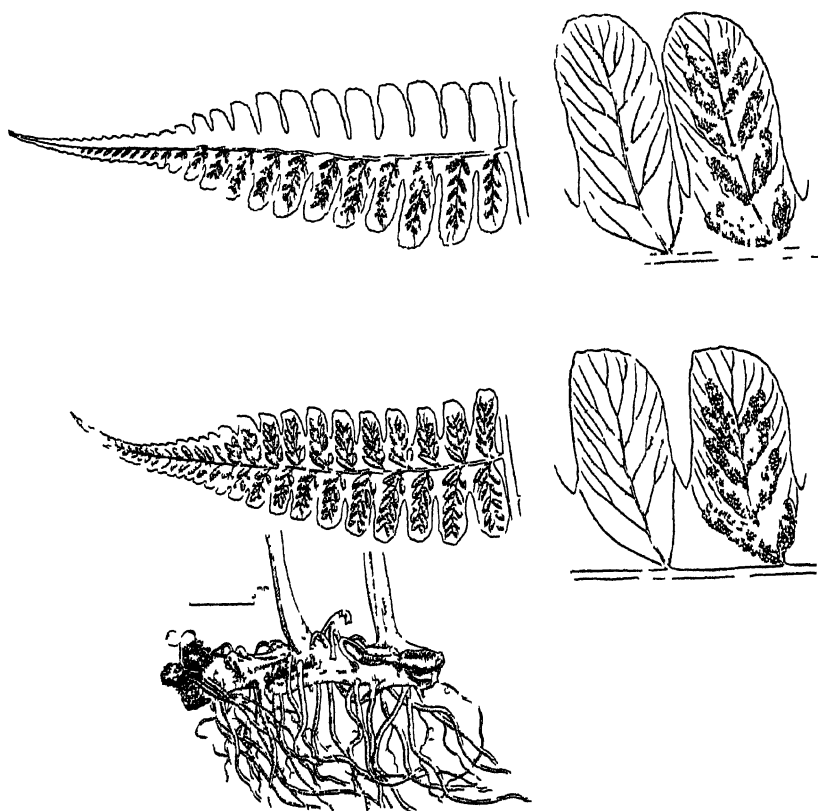


Fig. 4. *Diplazium procumbens*. On left, pinnules from different fronds, and on right enlarged portions of each to show veins and sori. Below, the procumbent rhizome.

versus leviter dentati. Venulæ ad 7-jugatæ, in lobi maximi omnes furcatæ, in lobi parvi plerumque simplices, costæ squamulis paucis parvis lanceolatis brunneis dentatis munitæ. Sori e costa in  $\frac{1}{2}$ – $\frac{2}{3}$  longitudine venularum sedentes, sorus infimus acroscopicus plerumque diplazio-deus; indusia tenuia membranacea.

TYPUS: Fraser's Hill, 4,000 ft., S.F.N. 36503 (Holtum).

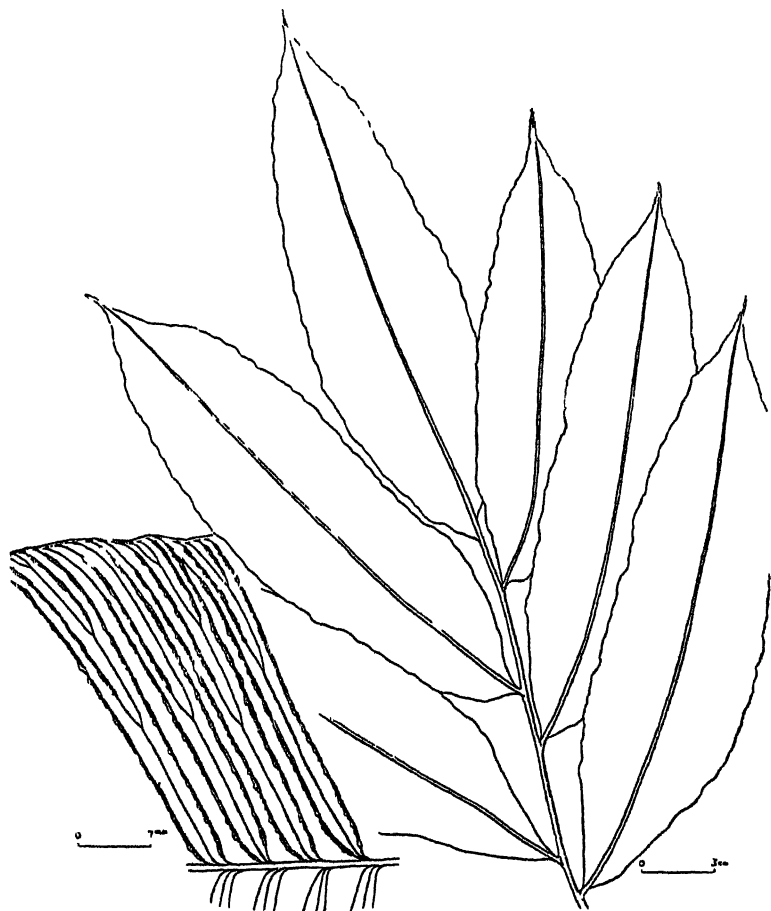
This species resembles *D. latisquamatum* in appearance, but differs in its narrow slightly toothed scales (round and entire in *D. latisquamatum*), procumbent rhizome, hardly muricate stipes, usually broader, more acuminate pinnæ, more copiously forked veins and longer sori with very thin indusia. It is abundant in the moist shady valleys, near streams, on the Pahang side of the divide at Fraser's Hill, and has not yet been found elsewhere.

Specimens in Singapore Herbarium:—

Fraser's Hill, 4,000 ft., S.F.N. 8844 (Burkill & Holttum), S.F.N. 11478 (Holttum), S.F.N. 21645 (Holttum), S.F.N. 37201 (Addison), s.n. Corner 12.8.37.

**16. *Diplazium riparium* Holttum sp. nov. Fig. 5.**

Rhizoma breve erectum. Stipites ad 50 cm. longi, in vivo virides, in sicco brunnei fusci, basi squamis lanceolatis, fere nigris, integris, 1–5 mm. longis, 1.5 mm. latis, vestiti, cetera nudi. Lamina pinnata, pinnæ laterales ad 5–jugatæ (superiores nonnunquam leviter adnatæ), pinna terminalis



**Fig. 5. *Diplazium riparium*, type; outline of frond. On left, below, detail of venation and sori, enlarged.**

ceteris similis, rachis non prolifera. Pinnæ maximæ ad 29 cm. longæ et 7 cm. latæ, brevissime stipitatæ vel sessiles, basi subæqualiter cuneatæ, margine fere integræ, apicem versus subito angustatæ et plus minusve caudatæ, cauda ad 2 cm. longa; costa sublus rotundata, in sicco brunnea vel fusca, nuda, supra in sicco canaliculata; venæ angulum plus quam  $60^\circ$  cum costa formantes, rarissime anastomosantes, in fasciculis parvis glomeratæ; fasciculus ex venis tribus constatus, vena medialis furcata (sæpe bis furcata); sori 3-4 pro fasciculo, sori venarum lateralium e costa fere ad marginem extensi, ceteri breviores, omnes prope marginem terminati.

TYPUS: Selangor, Semenyih, Hume 8186 (Herb. F.M.S. Mus.).

This species agrees with *D. xiphophyllum*, as I understand it, in Malaya, in its entire scales and rather large subentire pinnæ. It differs from *D. xiphophyllum* in the following characters: stipe and rachis darker when dry (stramineous in *D. xiphophyllum*); scales shorter, darker; fronds much shorter; pinnæ to about 5 pairs only, shorter and broader, almost or quite entire on old plants; anastomosis of veins rare, veins at more than  $60^\circ$  to midrib in mature plants, the ends of the veins uniting with a cartilaginous margin; rachis not gemmiparous.

Young plants have the first fronds simple, later fronds with one or more pairs of lateral pinnæ, which have distinctly toothed margins, especially towards apex, fertile from an early stage (on pinnæ from  $9 \times 2$  cm.), the lateral veins often making a smaller angle to the midrib than in the larger pinnæ of mature plants.

This is a fern of the lowlands only, in forest near streams, usually in wet places and often on stream banks. It has also been found in the low country of F. Sumatra and Sarawak. It has usually been referred to *D. bantamense*, from which it differs in its entire scales and lack of buds on the rachis, also in young plants not having hastate or cordate fronds. It also resembles *D. Donianum*, but this also (so far as specimens available indicate) has toothed scales. It may be very near *D. alternifolium* from Java, but appears to differ in more entire pinnæ and in fewer veins in each group (*D. alternifolium* has usually 3 pairs of lateral veins in each group, often all soriferous); I have not seen scales of *D. alternifolium*.

Specimens in Singapore Herbarium:—

PERAK. Upper Perak, 300 ft., L. Wray Jr. 3590 (young), 3650. B.P.D. 300-500 ft., King's Collector 7894.

PAHANG. Near K. Teku, 500 ft. (young plant), S.F.N. 20792 (Holttum); S. Cheka, young plant, S.F.N. 21780 (Holttum); Montakab, West, S.F.N. 21558 (Holttum).

KELANTAN. Ulu S. Ketch, Md. Nur, s.n. 14.2.21.

TRENGGANU. K. Brang, S.F.N. 15323 (Holttum).

SELANGOR. Semenyih, Hume, F.M.S. Mus. No. 8186 (Type).

MALACCA. Ayer Keroh, Ridley s.n. Dec. 1899. Ayer Panas, Ridley 1587.

SUNGEI UJONG. No loc., Alvins 3282.

JOHORE. Ulu Sedili, Holttum, s.n., May 1932; foot of G. Pantl, 200 ft., S.F.N. 18301 (Holttum).

SINGAPORE. Hullett s.n. Jan. 1881.

SUMATRA. East Coast, general region of Marbau, Rahmat si Toroos 222.

SARAWAK. No loc., Bishop Hose s.n., 1890.

17. **Diplazium silvaticum** (Bory) Sw. Syn. Fil. 92. 1806.  
*Callipteris silvatica* Bory, Voy. 1: 282. 1801.

Stock short, erect. Scales on young fronds and bases of stipes very dark, to about 10 mm. long and 1.5 mm. wide, closely and distinctly toothed, teeth often forked (see fig. 1). Stipes to about 40 cm. long. Frond simply pinnate, to about 50 by 20 cm., pinnæ numerous, lower stalked to about 5 mm., upper sessile; lowest pinnæ with upper base subtruncate, lower base cuneate; upper pinnæ with base broadly cuneate to truncate, more or less auricled above but not below; pinnæ to about 12 cm. long and 3 cm. wide (commonly less), apex acuminate, edges lobed to about  $\frac{1}{4}$  distance to costa, texture thin; lobes oblique, about 5 mm. wide, veins in pinnate groups with 3-4 pairs of lateral veins; sori from near base of veins  $\frac{3}{4}$  or more towards edge, sorus on acroscopic basal vein diplazioid, sometimes sorus on next acroscopic vein also, other sori simple.

This species, which I believe I have correctly identified, occurs throughout Malaya, but is not always easy to distinguish from *D. crenatoserratum*. It differs from *D. crenatoserratum* in having broader pinnæ of thinner texture, not auriculate on the lower base, and by the larger and closely and distinctly toothed scales, the teeth often forked. Some specimens approach *D. malaccanum* in appearance; they are distinguished by their toothed scales (scales of *D. malaccanum* are entire).

*D. silvaticum* was originally described from Mauritius. Malayan specimens, according to Christensen (Danske Bot. Ark. 7: 82. 1930), are very close to the type. This must be reckoned one of the most widely distributed species of the genus. Ceylon specimens in the Singapore herbarium

have scales like Peninsula plants, but have more ample fronds than any Malayan specimens. How far eastwards the species extends, I do not know. A Java specimen in the Singapore herbarium (quoted below) agrees quite well with Peninsula specimens.

Specimens in Singapore Herbarium:—

SINGAPORE. Hullett s.n. (2 sheets).

PAIHANG. Tahan River. Ridley 5818. S. Cheka, Holtum s.n., 26.4.31. Tembeling, S.F.N. 21701 (Holtum). Base K. Glanggi, S.F.N. 22122 (Henderson).

SELANGOR. Woods Batu Caves, Ridley s.n., Dec. 1891 (?). Klang Gates, F.M.S. Mus., Hume 7117.

PERAK. Upper Perak, 300 ft. Wray 3626, 3591. Gapis Pass, Curtis 1360.

KELANTAN. Gua Panjang, Gua Ninik, S.F.N. 19498 (Henderson).

KEDAH. Langkawi, G. Raya, Curtis s.n., Sept. 1890. 48 mile Jeniang Road, S.F.N. 35995 (Kiah).

JAVA. Djember, inter G. Boto et Tjuramamis, 600 m., Backer & Posthumus s.n. 11.3.29.

SIAM. Chawng (7° 35'), S.F.N. 24382 (Kiah, doubtful). Betong, Patani, 440 m., Eryl Smith 1929.

**18. *Diplazium simplicivenium* Holtum sp. nov. Fig. 6.**

Rhizoma breve erectum. Stipites 1 m. longi vel ultra, basin versus basibus squamarum deciduarum asperuli; squamæ 2 cm. longæ vel ultra, prope basin 1–2 mm. latæ, fuscæ, marginæ dentatæ, dentes simplices. Lamina 15 m. longa et 1 m. lata vel ultra, bipinnata. Pinnæ adjacentes c. 15 cm. inter se distantes, obliquæ; pinnæ maximæ 65 cm. longæ et 20 cm. latæ; pinnulæ liberæ ad 20–jugatæ, sub apicem lobatum laminæ; pinnulæ maximæ 12 cm. longæ, 2 cm. latæ, fere sessiles, basi truncatæ (non auriculatæ), apicem versus acuminatæ, e margine  $\frac{1}{4}$  costam versus lobatæ; lobi truncati, c. 7 mm. lati, leviter obliqui; venæ c. 5–jugatæ, omnes simplices; sori e basi venarum  $\frac{3}{4}$  vel ultra marginem versus extensi; textura laminæ tenuis, venæ utrinque distinctissimæ; costæ subtus (plerumque basin versus) squamis parvis paucis brunneis, margine fere nigris, munitæ.

TYPUS: Fraser's Hill, 4,000 ft. alt. S.F.N. 36507, leg. Holtum.

This species differs from *D. dilatatum* in the following characters: wider and longer scales of coarser texture; veins all simple (some may be forked on transition pinnæ near apex of frond, but none on the typical larger pinnæ, even

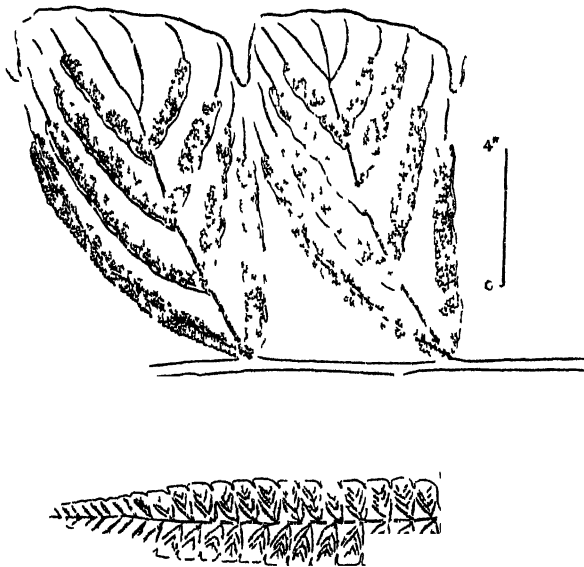


Fig. 6. *Diplazium simplicivenium*. Below, single pinnule from large pinna. Above, two lobes enlarged to show venation and sori.

of very large fronds); usually not more than 5 pairs of veins; sori occupying  $\frac{1}{2}$  or more of the length of the veins.

*D. simplicivenium* occurs in moist shady valleys near streams; it has been found on the Main Range, the Taiping Hills, and on G. Senyum in Pahang, also in Lower Siam. Some specimens from Borneo agree in having simple veins, but they have much wider pinnules than Peninsular specimens and I doubt their identity with this species.

Specimens in Singapore Herbarium:—

PERAK. No loc. Hullett s.n., 1881. Larut, 1,000–1,500 ft., King's Collector 2346; 1,500–2,000 ft. King's Collector 2214. Temango, Ridley 14211. G. Bubu, 600–800 ft., King's Collector 8420.

PAHANG. Tras Valley, 3,800 ft., S.F.N. 21636 (Holtum). Base of G. Senyum, S.F.N. 22388 (Carr).

SELANGOR. Ginting Simpah, Hume 9110 (F.M.S. Mus. Herb.).

LOWER SIAM. Khaw Poh Hill, Khsum, 1,200 ft., S.F.N. 3829 (Haniff & Nur).

19. *Diplazium sorzogonense* Presl, Tent. Pterid.: 111. 1836  
*Asplenium sorzogonense* Presl, Rel. Hænk. 1: 45.  
 1825.

Stock short erect. Stipes to c. 60 cm. long, scaly at base with long narrow entire scales, scales dark brown, sometimes with black edges, to about 15 cm. by 15 mm.; rest of stipe and rachis scaly with very narrow dark hair-like scales. Lamina simply pinnate, to about 80 by 10 cm., pinnæ to c. 20—jugate below pinnatifid apex of frond; lower pinnæ very shortly stalked, upper sessile, bases truncate or subtruncate, apices acuminate, margins lobed 3<sub>1</sub> or more to costa in lower pinnæ, less deeply in upper ones; lobes almost at right angles to costa, oblong, ends rounded and slightly toothed, 4–6 mm. wide above base; texture firm, drying rather dark; largest pinna to 25 × 5 cm., commonly less, veins in the lobes to about 10 pairs, all simple, basal  $\frac{1}{4}$ , usually free of sori; sori reaching almost to margin, the lamina below the sorus depressed, the depression with a distinct margin on the dried frond. Sori usually all simple near the base of a pinna, the acroscopic basal sorus of each lobe diplazioid towards apex of pinna. Indusia firm, persistent, rolled back when sorus is mature.

This species is found throughout Malaya, in lowland and mountain forest to 4,500 ft. altitude. It is a very widely distributed species, and though somewhat variable is always recognizable by the fibrillose stipe and rachis and the peculiar impressed sori, which I have not found in any other *Diplazium* of this region (except slightly in *D. subserratum*).

*D. sorzogonense* differs from *D. speciosum* in having entire scales, fibrillose rachis, and in the impressed sori. I think that the two species have sometimes been confused.

Specimens in Singapore Herbarium:—

SINGAPORE. Stagmount, Ridley s.n., 1907; Ridley 11271. Bukit Timah, Ridley s.n. 1897. Mandai Road, Corner s.n., 20.10.29.

PERAK. Kinta, 1,500–2,000 ft., King's Collector 7151. Taiping, Scortechini, March 1881. Tapah, Ridley 14023.

SELANGOR. Kwang, Ridley 13132.

PAHANG. Fraser's Hill, 4,000 ft., S.F.N. 11198 (Md. Nur); s.n., Holttum 20.3.29; s.n., Holttum 31.12.39. Cameron Highlands, 4,500 ft. s.n., Holttum 21.5.36. G. Rokam, P. Tioman, 2,000 ft., S.F.N. 18612 (Henderson).

PENANG HILL s.n. Dec. 1881, Hullett. S.F.N. 19302 (Holttum).

KEDAH. G. Lang 2,000 ft., S.F.N. 35012 (Kiah).

20. *Diplazium speciosum* Bl. Enum. 193. 1828.

Stock short erect. Stipes to 60 cm. long, clothed at the base with *shining brown scales with toothed but not blackened edges*, about 1.5 cm. long and 1.5 mm. wide at base; *rest of stipe and rachis glabrescent*. Lamina pinnate, to about  $70 \times 25$  cm. pinnae to about 20-jugate, to 20 cm. long and 3.5 cm. wide, lower pinnae on stalks to 4 mm. long, upper sessile, base truncate (on lower pinnae sometimes narrow), apex acuminate, *margins lobed more than  $3\frac{1}{4}$  way to costa in lower pinnae*; lobes 4–5 mm. wide above base, slightly oblique, oblong, ends rounded, edges shortly toothed, texture firm, drying rather dark brown; *veins to 10 pairs a each lobe, simple, sort from base of veins over  $2/3$  their length, not impressed*, often all simple, the *indusia thin but firm, not rolled back when sorus is ripe*.

In Malaya this species has only been found on G. Tahan, specimens from which differ from Kinabalu specimens in wider lobes of the pinnae; Peninsula specimens agree however with that from Mt. Dulit, Sarawak, quoted below.

*D. speciosum* has much the general appearance of *D. sorzogonense*, but lacks the fibrillose scales on stipe and rachis, has toothed scales at the bases of the stipes, and has sori not impressed. The lobes of the pinnae are also rather more deeply cut and more strongly toothed.

Specimens in Singapore Herbarium:—

PAHANG. Gunong Tahan, Ridley 15991; 5,000 ft., Haniff & Nur. S.F.N. 7953; 4,500 ft., S.F.N. 20747 (Holtum).

BORNEO. Dulit, C. Hose, Herb. Bishop Hose. Kinabalu, 5,000 ft., S.F.N. 25444 (Holtum).

Var. *major* (Bedd.) Holtum stat. nov.

*D. sorzogonense* v. *major* Bedd. Suppl. 40. 1892.

Differs from the typical form of the species in having fronds to 1.50 m. long, pinnae to 6.8 cm. wide, the lobes more acute and more strongly toothed, veins to 13 pairs, mostly forked.

PERAK. G. Bubu, 5,000 ft., King's Collector 7403 (type of variety); G. Bubu, 5,000 ft., Wray 3862.

PAHANG. Pine Tree Hill, 4,500 ft., S.F.N. 36508 (Holtum).

SUMATRA. G. Sibayak, 5,000 ft., S.F.N. 15457 (Holtum).

The type of Beddome's variety clearly belongs to this species and not to *D. sorzogonense*. It is a very fine fern and might perhaps rank as a species.

21. *Diplazium subintegrum* Holttum, Gard. Bull. S.S. 9: 125. 1937.

Stock short erect. *Scales on stipes brown, entire, to about 1.5 cm. by 2 mm. Stipes to 80 cm. long, pale when dry. Frond simply pinnate, to about 70 cm. long; pinnae to about 16 pairs, the apical lamina narrowly deltoid, lobed at the base. Pinnæ to 24 by 2.5 cm., lowest stalked to 1.5 cm., upper 2 or 3 pinnæ only sessile; bases almost equal, of lower pinnæ narrower, cuneate; edges toothed, apices acuminate. Veins forked near the costa, the upper branch always simple, the lower branch forked 1-4 times; sori on upper branch from base  $2/3-3/4$  of way towards margin, diplazioid, usually also on one branch only of the lower vein, simple.*

A mountain species, related to *D. montanum* and *D. pallidum*, differing from the latter in larger brown scales, longer stalks and narrower bases of pinnæ, more branched veins and normally diplazioid sori; differing from *D. montanum* also in the narrowly deltoid lobed apex of the lamina. This species appears to be confined to the Main Range of the Malay Peninsula and the Taiping Hills, at 3,000-5,000 ft. The specimens in the Singapore Herbarium were cited with the original description quoted above; no more have since been acquired.

22. *Diplazium subserratum* (Bl.) Moore, Index 338. 1862.  
*Asplenium subserratum* Bl. Enum. 174. 1828.

Stock slender, erect or decumbent. *Stipes slender, clustered, 10-20 cm. long, glabrescent, clothed when very young with small very dark scales, 2-3 mm. long and less than 1 mm. wide, the edges very shortly toothed. Lamina simple, to about 50 cm. long and 4 cm. wide, narrowed gradually to the base which is suddenly contracted from a width of a few millimetres, and very gradually to the acuminate apex; margins entire or irregularly undulate, toothed towards apex; texture very firm. Midrib grooved above, prominent beneath and bearing scattered dark brown ovate-lanceolate scales 1 mm. long or less; scales also on some of the lateral veins beneath. Veins in small groups at an angle of about 60° to the midrib, the groups about 5 mm. apart. Each vein-group formed by forking at the midrib, the acroscopic branch being simple and the lower forked 2-4 times again; the simple acroscopic branch usually sori-ferous and often one, more rarely two, branches of the basiscopic vein also. Sori on acroscopic vein diplazioid, varying in length, often from the base almost to the edge of the lamina; other sori simple and shorter; indusia firm,*

persistent, when old rolled back as in *D. sorzogonense*, and leaving a faint mark on the lamina to show their size and position when young.

This species in Malaya is confined to moist shady mountain valleys, near streams. It is the only Malayan species with narrow simple fronds, and so is easy to recognize. Young plants have fronds which are dissected to the midrib, indicating a probable origin from a pinnate ancestor. The resemblance of the indusia to *D. sorzogonense* is interesting.

*D. subseriatum* is probably allied to *D. lanceum* of India and China, but is larger, and has a shorter rootstock which is more or less erect with tufted fronds; the scales also appear to be smaller.

### 23. *Diplazium tomentosum* Bl. Enum. 192. 1928.

Stock short, erect. Scales on stipes to about 4 mm. long and  $\frac{1}{2}$  mm. wide, acuminate, dark to medium brown, the edges irregular but hardly toothed. Stipes to c. 40 cm. long, frond to about 35 by 15 cm., pinnæ many, lowest shortly stalked (to 3 mm.), upper sessile or adnate; lowest pinnæ largest, somewhat deflexed and curved, widest  $\frac{1}{3}$  from base, base narrow, apex acuminate, to 3 cm. wide; middle and upper pinnæ narrower, with parallel sides, almost at right angles to rachis, slightly curved, base truncate, auricled above, broadly cuneate below. All pinnæ of large fronds deeply lobed (half way or almost to the costa), lobes c. 3 mm. wide above the base, at an angle of less than  $60^\circ$  to the costa, their edges slightly toothed at the tip. Veins pinnate in the lobes, the veinlets usually forked, up to 7 pairs or more, often all or almost all veins soriferous, the lowest acroscopic vein with sorus directed towards the main costa or diplazioid. Texture firm, drying very dark; rachis and costa beneath densely covered with short multicellular hairs with pale cells and dark brown cross-walls.

Young plants have almost entire pinnæ; these approach *D. crenatoserratum* in appearance but are distinguished by their more hairy rachis and costæ beneath, usually narrower more pointed pinnæ, more deflexed, shorter-stalked lowest pinnæ which are broadest near the middle, and darker colour on drying. Fully developed plants, with their deeply lobed pinnæ and deflexed almost elliptical lowest pinnæ are quite distinct.

*D. tomentosum* is closely related to *D. velutinum*, a mountain plant with more deeply dissected, though hardly larger fronds. The tomentum of both is of the same character.

*D. tomentosum* is a common species in lowland and mid-mountain forest throughout Malaya; it seems unnecessary to enumerate all the many specimens.

24. *Diplazium velutinum* Holttum Gard. Bull. S.S. 9: 126. 1937.

Caudex short erect. *Stipes* to 10 cm. long (commonly about 20 cm.), clothed throughout with scattered multicellular brown hairs, and towards the base with narrow almost black entire scales, scales to about 1 cm. long and barely 1 mm. wide at the base. *Lamina* bipinnate, to about 25 cm. long and 15 cm. wide, the rachises and costae beneath densely clothed with brown hairs like those on the stipe, with a few small narrow scales. Free pinnae 12–15 pairs, the sub-basal largest, the upper ones gradually reduced and grading into the lobed apical lamina. *Largest pinnae* c. 8 cm. long and 3 cm. wide (commonly about 6 by 2 cm.), subsessile, narrowed from truncate base to acute or acuminate apex, pinnate towards the base only, for the rest lobed almost to the costa, the pinnules or segments at right angles to the pinna-rachis at the base, gradually more oblique towards the apex. Free pinnules few, the rest more or less broadly adnate to the pinna-rachis; *largest pinnules* about 12 mm. long and 4 mm. wide, base unequally cuncate, margins serrate or lobed as much as half-way to the costule, apex rounded, texture very firm. Veins in pinnules or pinna-lobes 7–10–jugate, mostly forked; sori on basal  $\frac{1}{2}$ – $\frac{2}{3}$  of veinlets; in the largest pinnules several diplazioid sori, in smaller pinnules only one such sorus; indusia thin, broad, persistent.

This species, closely related to *D. tomentosum* but much more deeply dissected, has hitherto only been found in the moist shady valleys at Cameron Highlands, 4,800–5,000 ft. above sea level. No further collections have been made since my paper above quoted.

25. *Diplazium xiphophyllum* (Baker) C. Chr., Ind. Fil. 211 1905.

*Asplenium xiphophyllum* Baker, J. Bot. 1879: 10.

Stock short, erect. *Stipes* to 70 cm. long, drying pale, clothed at the base with dull brown entire scales to 1.5 cm. long and 2 mm. or more wide at the base. *Lamina* simply pinnate; *pinnæ* in adult plants to 12 pairs, terminal pinna like the rest, texture thin, colour light green when fresh, light brownish when dry; lower pinnæ on very short stalks (2 mm. long), uppermost slightly adnate to rachis, with buds sometimes in their axils. *Largest pinnæ* to about 35 by 6 cm., elliptical, narrowed gradually to the slightly unequal base and more abruptly to the acuminate-caudate

apex; *edges slightly and irregularly toothed throughout*; midrib pale, prominent and glabrous beneath, *lateral veins in small groups, at 45° to the midrib*, commonly of one basal pair and one central vein which is forked, one or both of its branches also forked; *veins occasionally anastomosing near margin but never copiously anastomosing, ending distinctly within the margin* and not united to it. Sori on basal pair of veins in each group, from near midrib to near margin, on other veins shorter, commonly 3–4 sori on each vein-group, the sorus on the anterior basal vein only diplazoid.

The above description applies to ferns found in the Malay Peninsula. The type of the species *D. xiphophyllum* is from Borneo (Labuan, coll. Burbidge, at Kew), and shows a frond of a young plant with narrow pinnæ, and detached pinnæ from a mature plant, these being 30 by 3 cm. There is therefore some doubt whether the Peninsula plant (matched also by the Kinabalu specimens quoted below) is really this species, more especially as young plants from Malaya have quite broad pinnæ. I do not, however, know any other species to which our fern could be referred.

*D. xiphophyllum*, as here interpreted, is a fern of lowland and mid-mountain valleys, the highest altitude recorded in Malaya being 3,000 ft. It is fairly constant in character, differing from *D. riparium* in its much larger size and in other points mentioned under that species. There is one aberrant collection, that of Burkill from Ulu Chineras, which has long narrow pinnæ (to 3.8 cm. wide), long acuminate with edges more deeply toothed than normally, the vein-groups less branched and without anastomosis, and fewer sori in each group.

Specimens in the Singapore Herbarium:—

SIAM. Patani, 160–350 m., Eryl Smith 1922; Khao Rum, Eryl Smith 618.

PERAK. No loc., Herb. Mus. Perak 234; Jor Camp, Henderson F.M.S. Mus. 10833; Waterloo, Curtis 1361 p.p.; Larut, 3,000 ft., King's Collector 2698; Temango, Ridley 14227.

PAHANG. Ulu Chineras, K. Lipis, S.F.N. 15692 (Burkill).

SELANGOR. Ginting Peras, Ridley 7833; Ginting Simpah, 2,000 ft., S.F.N. 34310 (Md. Nur), 1,500 ft., Hume 8782, 8777, 8542; Kajang, Symington 24200 (F.D.).

BORNEO. Kinabalu, 5,000 ft., Clemens 29406; 3,500 ft., S.F.N. 25258 (Holtum).

## LIST OF COLLECTORS' NUMBERS CITED

(The figures in brackets refer to the numbers given to the species in this paper)

<i>S.F.N.</i>	25444 (20)	10849 (13)
3829 (18)	31194 (9)	10959 (12)
7953 (20)	31295 (13)	<i>Hume (Herb.</i>
8844 (15)	31334 (5)	<i>F.M.S. Mus.)</i>
9770 (13)	32937 (13)	8551B (13)
9876 (2)	34310 (25)	7117 (17)
9982 (13)	35012 (19)	8186 (16)
10018 (2)	35995 (17)	8542 (25)
11007 (10)	36503 (15)	8777 (25)
11198 (19)	36504 (10)	8782 (25)
11473 (2)	36505 (2)	8997 (14)
11478 (15)	36507 (18)	9110 (18)
11515 (13)	36508 (20 var.)	9347 (14)
11563 (11)	37159 (2)	9665 (14)
14103 (13)	37201 (15)	9677 (11)
15323 (16)	<i>Ridley</i>	<i>Curtis</i>
15403 (5)	1587 (16)	1352 (8)
15457 (20 var.)	2167 (12)	1360 (17)
15692 (25)	2400 (13)	1361 p.p. (2)
17978 (2)	5818 (17)	1361 p.p. (25)
18301 (16)	7833 (25)	3369 (14)
18583 (12)	7843 (9)	10135 (13)
18612 (19)	7852 (9)	<i>Eryl Smith</i>
19302 (19)	8139 (12)	618 (25)
19342 (13)	8652 (9)	1198 (5)
19346 (2)	11271 (19)	1922 (25)
19498 (17)	13432 (19)	1927 (14)
19776 (13)	13975 (13)	1929 (17)
20554 (2)	14023 (19)	1930 (14)
20747 (20)	14206 (13)	1948 (12)
20792 (16)	14209 (12)	<i>Forest</i>
21636 (18)	14211 (18)	<i>Department</i>
21645 (15)	14227 (25)	14602 (13)
22089 (13)	14229 (2)	21200 (25)
22388 (18)	15991 (20)	<i>Herb. F.M.S.</i>
22422 (17)	<i>King's Collector</i>	<i>Mus.</i>
23262 (13)	( <i>Kunstler</i> )	10833 (25)
23340 (2)	2214 (18)	<i>Wray</i>
23361 (13)	2346 (18)	3590 (16)
23518 (13)	2391 (14)	3594 (17)
23620 (5)	2698 (25)	3616 (2)
24382 (17)	7146 (14)	3626 (17)
24558 (16)	7151 (19)	3862 (20 var.)
24703 (12)	7403 (20 var.)	<i>Haniff</i>
24704 (17)	7894 (16)	4047 (12)
24780 (16)	8420 (18)	<i>Alvins</i>
25258 (25)	8797 (9)	3282 (16)

CARPET GRASS, *AXONOPUS* SPT.

By R. B. JAGOE

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## INTRODUCTION

For many years the apparent difference between broad-leaved and narrow-leaved forms of *Axonopus compressus*, or Carpet grass, has not been generally regarded as of specific rank, although the names *Paspalum platycaule* Poir. for the broad-leaved form, and *Paspalum compressum*, for the narrow-leaved form, have been used by some persons. The original *Paspalum compressum*, Swartz., is however, undoubtedly the broad-leaved grass.

These two Carpet grasses have now been recognised as distinct species, the broad-leaved form retaining the present name (*Axonopus compressus* Beauv.), while Miss Agnes Chase, an American authority, has defined the narrow-leaved grass as a new species, and named it *Axonopus affinis*, as follows:—

*Axonopus affinis*, sp. novo.

Ab *Axonopus compresso* differt: Culmis et stolonibus gracilioribus, laminis augustioribus; spiculis brevioribus, 2 mm. longis, obtusis vel subacutis. (Culms and stolons more slender, leaf-blades narrower; spikelets shorter, 2 mm. long, obtuse or sub-acute).

"The plants are more tufted than in *A. compressus*, sometimes forming dense mats with short rhizomes, and the flowering culms in such colonies are relatively few.

Stolons slender, the internodes short, and the leaf-blades (usually) not conspicuously shorter than those of the culms, as in *A. compressus*.

Culms erect or geniculate ascending, slender, nodes glabrous (?) sheaths compressed, on the average narrower than those of *A. compressus*, leaf-blades flat or folded, 2 to 6 mm. wide.

Peduncles very slender 1 to 3 within uppermost sheath of flowering culm, finally elongate; racemes 2 to 4; 2 to 10 cm. long, spikelets oblong-elliptic rather more plump than in *A. compressus*, 2 mm. long, 0.8 to 0.9 mm. wide, blunt or abruptly acute. The glume and sterile lemma equal, covering the fruit or slightly pointed beyond it, 4 nerved, mid-nerves suppressed, sparsely silky-pilose at base and summit, and sometimes along the nerves. Fruit pale, 1.7 to 1.8 mm. long, blunt." (Agnes Chase).

## HISTORY

*Axonopus compressus*, Beauv., is a native of the West Indies and tropical America, and has spread to Florida and Louisiana in the United States. It was introduced to Singapore about 1895 to 1900, for Ridley refers to *Paspalum*

*platycaule* in 1903 as "lately established in Singapore", since when it has spread to all parts of Malaya, thriving under light or medium shade.

*Axonopus affinis*, Chase, is a native of the southern United States, and is common in the southern States from Carolina to Texas. This species was introduced as "Carpet grass" to the Central Experiment Station, Serdang, in 1921, seed being sent to the Department of Agriculture by the late Professor C. V. Piper of the Agronomy Section of the United States Department of Agriculture. It has been distributed to many parts of the peninsula, but has not yet spread widely.

### DESCRIPTIONS

The two grasses are readily distinguished, although the broad-leaved species, *A. compressus*, in some circumstances, such as dry, shady conditions, produces long comparatively narrow leaves, little different superficially from those of *A. affinis*.

The distinguishing characters of the two species as found in Malaya differ slightly from those given by Miss Chase and detailed descriptions will be given below.

As stated above, the plants of *A. affinis* Chase, are more densely tufted than those of *A. compressus* Beauv. The former species is normally more free flowering, and the inflorescence peduncles are usually more elongated or extended.

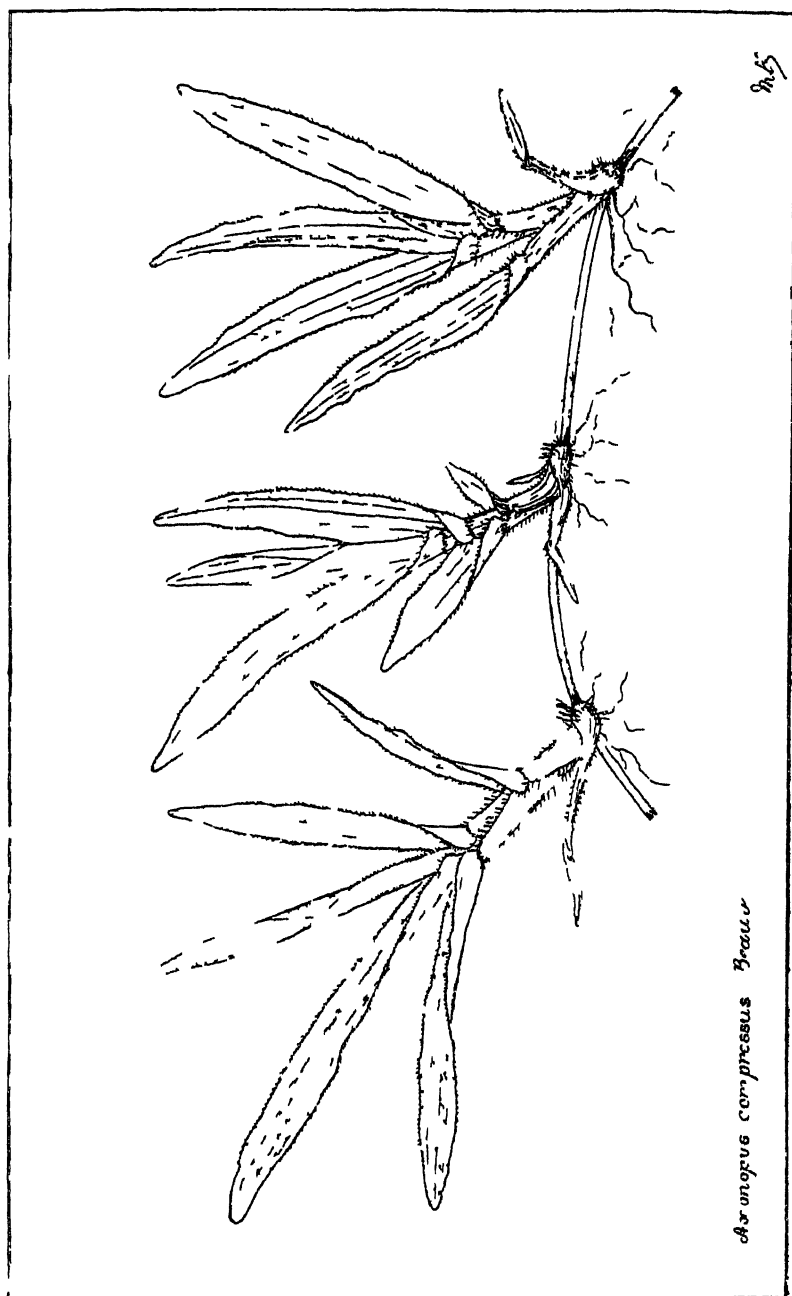
**Leaves.**—Growing in the same conditions, the leaves of *A. compressus* are larger than those of *A. affinis*, the blades being much broader, though shorter.

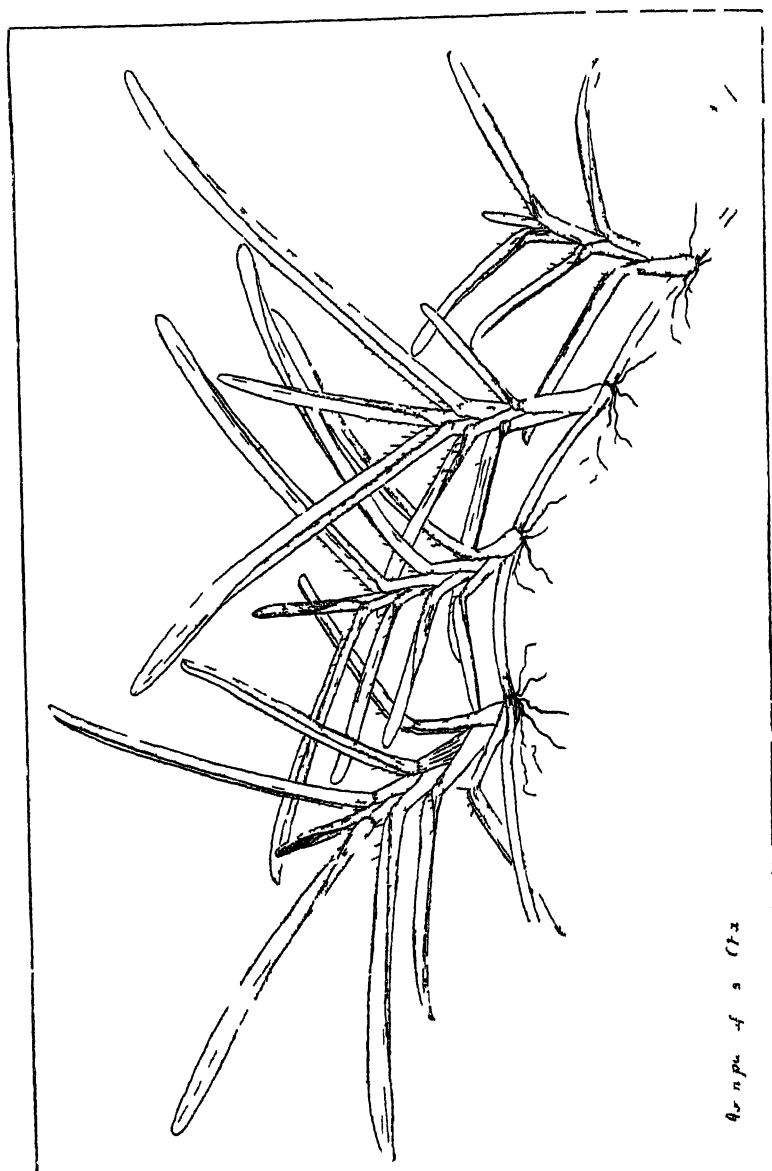
Further distinguishing features are as follows:—

Leaf-blades of *A. compressus* are wavy-edged and bright green, with conspicuous hairy fringes along the edges of the lower three-quarters of the blades. The edges of the sheaths and the ventral surfaces of the blades are hairy, with a few hairs also on the backs of the blades. The blades taper more at the ends and have less blunt-pointed tips.

The leaf-blades of *A. affinis* are longer and stiffer, and are slightly duller green in colour. They are very much less hairy, sometimes hairless, but usually with comparatively few, though long, hairs along the edges of the blades and sheaths, and seldom any on the surfaces of the blades. The edges of the blades are nearly parallel and the tips are blunt. The ends of the leaf-blades in both species are minutely hairy.

The backs of the blades of *A. affinis* are much more prominently keeled, and tend to fold in two, especially when withered or dry.





A further point of difference between the two species is that a red coloration in the leaves of *A. compressus* is very common especially in dry exposed situations, but it is extremely rare in those of *A. affinis*.

**Stolons.**—Both species are freely stoloniferous; stolons vary from fairly slender to comparatively stout, and there is little if any difference between the species in this respect. Stolons are branching; inter-nodes are short, shorter on the average in *A. affinis*; nodes are free-rooting.

In *A. compressus* the stolon nodes are very white-hairy, but in *A. affinis* they are only sparsely hairy.

In *A. compressus* the leaf-blades of the stolon growth stages are often conspicuously shorter than those of flowering culms, while in *A. affinis* this is not so notable.

*A. compressus* is now fairly common under rubber trees, and there grows most often in tufted fashion, conditions presumably being not very favourable for normal stoloniferous growth.

**Flowering Culms.**—Every stolon node bears a potential flowering shoot and when circumstances demand or are suitable, shoots from the nodes form flowering culms. At times, small or large leafy colonies of flowering culms are produced on branching rhizomes from the stolon nodes.

The flowering culms proper have only one inter-node, though at times they appear to have two or three. These extra internodes are the result of stoloniferous internodes being formed and assuming a more or less erect attitude, due to the urge to form floral organs coinciding with good conditions for vegetative growth.

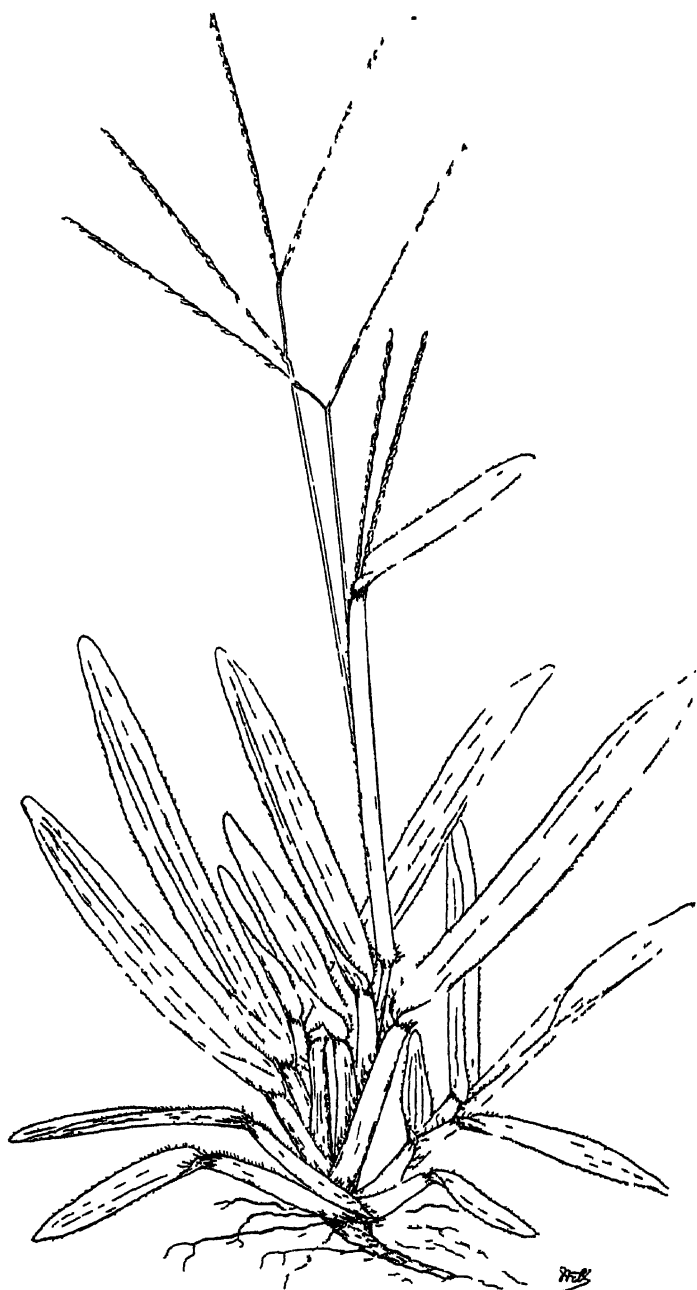
The flowering culms develop with the elongation of the basal internode, from the upper node of which and within the final leaf-sheath is a conic "disc" bearing 4 to 6 long bracts each subtending an inflorescence peduncle.

The blade of the uppermost leaf is short, especially so in *A. affinis*.

The nodes of the flowering culm are, in *A. compressus*, most usually densely white-hairy, though not always all the way round, while in *A. affinis* only the edges of the compressed nodes are (usually) hairy, but sometimes quite glabrous.

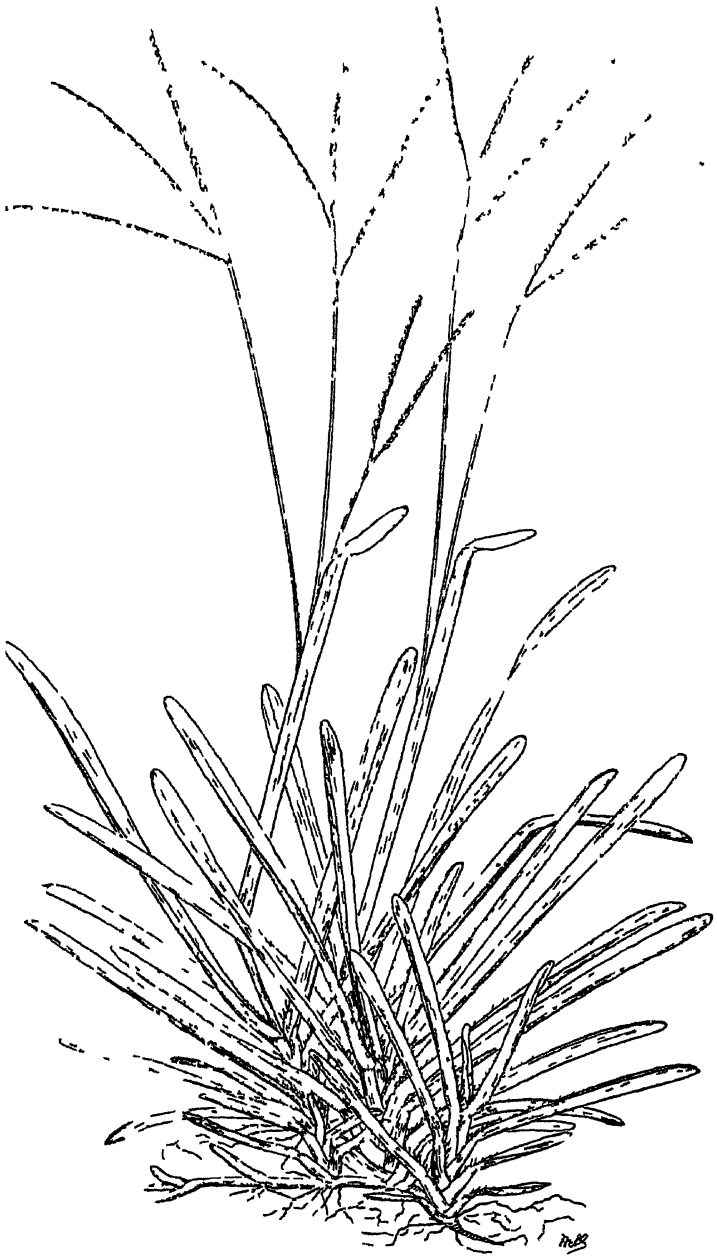
The full details of the morphological differences of the flowering culms are however, more conveniently described by taking each species separately.

*Axonopus compressus* Beauv. Flowering culms fairly slender, compressed. Nodes more or less silky hairy, leaf-blades 5 to 14 mm. wide, 6 to 28 cm. long; uppermost blade usually short but from 3 to 19 cm. long. From the cone on upper node of culm, 4 to 6 slender peduncles (1 to 4 conspicuous) 10 to 30 cm. long. Very frequently in *A.*



*Axonopus compressus* Beauv

*Gardens Bulletin, S.S.*



*Axonopus affinis*, Chase

*compressus*, these inflorescence peduncles remain short, and are not elongated beyond the mouth of the leaf-sheath. Each peduncle bears 2 or 3, rarely 4 to 6 slender racemes, the first two of which are at the apex of the peduncle, one terminal, the second subterminal, with others, when present, alternately at short intervals below. Racemes 1 to 10 cm. long.

Spikelets usually silky hairy, not closely spaced, alternating in two rows on a slender flattened or triangular rachis. Spikelets 20 to 28 mm. long, 0.8 to 1.0 mm. broad. Glumes II and III membranous, pale green with darker veins, hairy, conspicuously pointed, and extending beyond the fruit. Glume IV often reddish coloured. Glume V and palea chitinous. Stamens three, anthers yellow (when full of pollen) with narrow purple outer edges. Stigmas white.

*Axonopus affinis* Chase. Usually more free flowering than *A. compressus*. Flowering culms slender, compressed. Nodes more or less glabrous. Leaf-blades 4 to 8 mm. wide, 6 to 30 cm. long, uppermost blade on culm very short, 2 to 6 cm. long. From cone on upper node of culm 3 to 6 very slender peduncles (1 to 3 conspicuous), 15 to 30 cm. long. Each peduncle bears 2 or 3, occasionally 4 to 6, slender racemes, the first two racemes at the apex of peduncle, one terminal, the second subterminal, the others, when present, alternating at short intervals below. Racemes 3 to 10 cm. long.

Spikelets usually hairy, not very closely spaced, alternating in two rows along a slender flattened or triangular rachis, 1.8 to 2.2 mm. long, 0.8 to 1.0 mm. broad (they are much less pointed than those of *A. compressus*). Glumes II and III membranous, pale green with dark veins hairy, hardly extending or extending to a short point beyond the fruit, mid vein very indistinct. Glume IV often reddish coloured. Glume V and palea chitinous. Stamens three, anthers purple with translucent dots. Stigmas mauve.

Both species produce seed freely.

#### UTILITY

*A. affinis* withstands dry weather better than *A. compressus* and is capable of covering the soil better in dry exposed situations. On poor, unshaded soil, in this country, the former species frequently grows by densely-leaved, short internoded stolons, and it is probable that it will, in time, largely predominate in such conditions.

Under medium shade, however, where both make their best growth, *A. compressus* appears to have a distinct advantage.

There is some slight confusion as to palatability and value of carpet grass as pasture, but this is partly due to the previous confusion of two species with but one name.

There is no doubt that the true *Axonopus compressus* Beauv. is a good pasture grass, being recognised as such in tropical America and Australia. It appears equally true that *A. affinis* has a variable reputation. It is definitely regarded as inferior in Australia, and chemical analyses quoted by McLennan clearly show it to be inferior, as fodder, to *A. compressus*.

In Malaya a few years ago *A. affinis* appeared to be liable to cause purging of cattle, due to a slight increase in hydrocyanic acid content if cut at too short intervals. The author has, however, seen *A. affinis*, under light shade, grazed by cattle with relish, and obviously in preference to *Paspalum conjugatum*.

#### SUMMARY

A detailed account is given of the two species *Axonopus compressus* Beauv., and *Axonopus affinis* Chase, and the differences between them.

The chief distinguishing features may be summarised as follows:—

<i>A. compressus</i> Beauv. Savannah Grass.	<i>A. affinis</i> Chase. Carpet Grass.
LEAVES.—Broad, hairy frequently with red colouration.	Narrower, stiff, folded, more or less glabrous.
NODES.—Very hairy.	Hardly hairy.
SPIKELETS.—Long and pointed.	Blunt or short pointed.
ANTHERS.—Yellow with narrow purple outer edges.	Purple, with translucent dots.
STIGMAS.—White.	Mauve.

The writer wishes to acknowledge with thanks much careful work by his Laboratory Assistant, Che Mohd. Kassim, in the preparation of the illustrations.

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Bulletin 82, 1939.
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## PERIODIC LEAF-CHANGE AND FLOWERING OF TREES IN SINGAPORE (II)\*

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In my earlier paper on this subject, I published observations made on a number of trees during the years 1927-1931, and summarized previous observations published elsewhere on the behaviour of trees in the eastern tropics. I also gave a short account of the climate of Singapore. The main item of new information arising from my own observations was that a number of deciduous trees had fairly constant leaf-periods, which had no relation to the yearly calendar; and the conclusion drawn from this was that the length of leaf-period in such trees is due primarily to senescence of leaves, the climate of Singapore being so uniform as to have little or no control.

Subsequent observations, in some cases over a total period of ten years or more, have confirmed the fact that many deciduous trees have fairly constant leaf-periods not related to climate; but they have also shown many curious irregularities which are not always easy to explain. It is clear that there is every variety of response from almost complete independence of climatic change to extreme susceptibility, and a tree that is regular in behaviour for a time may later show an unexpected change (*e.g.* *Koompassia*).

My earlier generalizations therefore need modification in some measure, and a fuller discussion of the whole subject is given below, followed by details of behaviour of individual trees.

### Climate

The temperature of Singapore is so uniform throughout the year as to have little significance in the present connection. The only phenomena of temperature-change which influence plant behaviour are sudden falls of 10 to 15 degrees (Fahrenheit) during storms, and possibly also cool days following hot weather. These stimulate certain plants to flower; chiefly orchids, but also some woody plants, notably *Pterocarpus indicus*.

The average rainfall of Singapore is nearly 100 inches (2540 mm.), uniformly distributed, the driest calendar month having a mean of about 6 inches (152 mm). The only constant periodic change in the climate is the wetter season from October to January, when in addition to the greater rainfall there is frequent heavy clouding and light rain, resulting in continuously moist conditions over considerable periods, in contrast to the relatively short

\* For the first paper on this subject, see Gard. Bull. S.S. 5: 174-206. 1931.

periods of heavy rain characteristic of most of the rest of the year. There is often a sudden break at the end of the wet season, in January or February, and this is usually the most pronounced climatic change in the year. It varies in its intensity.

Though the driest month has a mean rainfall of about six inches, there are drier months than this in almost every year. A list of the calendar months with less than 2.5 inches of rain (63 mm.) since 1890 shows the following frequency of occurrence:

February	.	.	7 times
March	..	.	3 "
April	.	.	1 "
July	..	.	6 "
August	.	..	3 "
September	..	.	2 "

Thus there is an indication that exceptionally dry weather tends to occur either about February–March or July–August, but it will be noted that in 49 years there were only 22 calendar months with less than 2.5 inches of rain, and (as shown by the figures at the end of this paper) there is very great variation in the distribution of rainfall from year to year. In the period 1927–1937, the following were the longest periods without rain:—

24. 1.35–14. 2.35	.	22 days
21. 7.35– 9. 8.35	..	20 "
3. 2.33–19. 2.33	.	17 "
8.12.34–23.12.34	.	16 "
13. 7.28–27. 7.28	.	15 "
26. 7.29– 9. 8.29	.	15 "
24. 7.37– 6. 8.37	..	14 "

The extremes of dry weather are thus relatively slight as compared with most tropical climates, and are never such as to necessitate leaf-fall of trees; and though extreme dry weather may usually occur about February and July, it is not frequent enough to ensure uniform behaviour of all trees, and lesser dry periods may occur at almost any time. Dry periods of from 7 to 13 days occurred as follows in 1927–1937:

in January	..	.	2 periods
February	..	.	4 "
March	..	..	5 "
April	.	..	1 "
May	..	..	5 "
June	..	..	3 "
July	.	..	9 "
August	..	..	2 "
September	..	..	4 "
October	..	..	2 "
November	..	..	— "
December	..	..	1 "

A period of seven days without rain, following a period of wet weather, is probably enough to stimulate certain

trees to flower; but response varies according to the condition of the tree, and is in fact so complex that it is difficult to analyse. Reference to *Fagraea fragrans* and *Saraca taipingensis* will give some indications on this point. Most trees (other than those that flower continuously) probably need more than seven days drought as a stimulus to flowering.

Atmospheric humidity is high every night, rising above 90% soon after sunset; in the daytime it may fall to about 60% in dry weather, but in the wet season often only to 85%.

An appendix to this paper gives the daily rainfall, in inches, at the Botanic Gardens, Singapore, from 1927 to 1939.

### **Deciduous trees with annual leaf-renewal**

Trees of the following species have been strictly annual in their leaf-renewal:

*Kigelia pinnata* (mean date 28 January)

*Hymenaea courbaril* (early February)

*Parkia javanica* (mean date 23 February)

*Terminalia subspatulata* (mean date 6 April)

*Canarium rufum* (mean date 9 May)

*Lecythis* sp. (mean date 11 August)

The coefficients of variation of these trees vary from 2.0% to 7.5%, and presumably indicate corresponding differences in susceptibility to climatic variation.

The mean dates of leaf-renewal are interesting. It is probably significant that the two trees with the lowest variation (*Parkia* and *Kigelia*) renew their leaves in January–February, following the most regular seasonal change in the climate, whereas those with mean date of leaf-renewal in April and May (*Terminalia* and *Canarium*), when there is much variation of climate conditions, show the greatest variation. *Lecythis*, changing about August, is intermediate. *Hymenaea* is not quite deciduous, and no exact dates are recorded, but the tree concerned seems to be quite regular in its behaviour.

There are other trees that appear to have a tendency to a period of slightly less or slightly more than 12 months. Such trees as these may keep to very near 12 months for some years, if they change their leaves at a time when dry weather is most likely to occur; but sooner or later they have a short or a prolonged leaf-period, and this may be the prelude to a series of irregular periods until the change occurs once more at a time when climatic change is most regular. For an example of shortening periods see *Cassia nodosa*; for lengthening periods *Koompassia malaccensis*. The latter had been observed over three periods when I

wrote my earlier paper; it then appeared to have a period of exactly a year, with leaf change in September. It subsequently deferred its change until November and then had several periods of considerably more than 12 months.

Two young trees of *Kigelia pinnata* have indicated that the date of leaf-renewal may be dependent on the date of planting, and also that root-stimulus by manuring and cultivation may induce new growth and result in a change of some months in the date of leaf-renewal. The relation of the first leaf-change to the date of planting of a young tree is one that varies considerably from species to species, and observations on this point would be of considerable interest.

### Deciduous trees with leaf-period of more than a year

Several deciduous trees have been observed to show a mean leaf period significantly more than 12 months. These are as follows:

Species	Period (months)	s.d.		No. of periods
<i>Cedrela Glaziovii</i> A ..	12.5	.70	or 5.6%	11
<i>Koompassia malaccensis</i>	12.7	1.36	10.7%	12
<i>Hevea braziliensis</i> ..	13.3	86	6.5%	9
<i>Cedrela Glaziovii</i> B ..	14.0	1.7	12.1%	10
<i>Caesalpinia ferrea</i> ..	14.2	1.2	8.5%	5
<i>Homalium grandiflorum</i>	13.7	1.9	13.9%	7
<i>Anisoptera megistocarpa</i>	13.8?	1.65?	12.0%	10?
<i>Parishia Maingayi</i> ..	15.6	.96	6.2%	6
<i>Heritiera elata</i> ..	20.5	2.6	12.7%	4
<i>Heritiera macrophylla</i> ..	32	1.3	4.1%	4

The two trees of *Cedrela Glaziovii* provide a remarkable contrast, as they are growing near together and under apparently identical conditions. It is remarkable that the tree showing a period of only 12.5 months, which one might perhaps think not significantly different from 12.0 months, has had a very small coefficient of variation over a period of eleven years. The other tree, which evidently has a tendency to decidedly longer periods, is probably also more influenced by climatic change. Climatic influence is more clearly seen in the *Koompassia*, which has had its longest leaf-periods when change was due in the wet season. Such a tree may show almost exactly 12-month periods for several years, then a series of longer periods with change later and later in the wet season, then a series of nearly 12-month periods again. The *Koompassia* tree in question would probably be a strictly 12-month tree in a climate with a pronounced annual dry season. (Another *Koompassia* tree seems to be more irregular).

The *Hevea* with a very regular period of over 13 months is also interesting, because most *Hevea* trees in

Singapore are very irregular in their behaviour, changing some or all leaves at any period of dry weather (according to their previous history and the intensity of the drought). Schweizer's observations in a much more seasonal climate in Java indicate also variation in behaviour of different trees of *Hevea*; for further notes on this question, see below under the heading *Deciduous Trees with no regular leaf-periods*.

The behaviour of the *Anisoptera* tree has been decidedly irregular, and it is not at all obvious how climatic influence can have caused the observed variations. The *Homalium* tree also had one exceptionally long period which seems unaccountable on climatic grounds.

The two species of *Heritiera* are the most remarkable cases in this group, one being native to Malaya and the other from Burma. It would be very interesting to have some information about the behaviour of *H. macrophylla* in its seasonal native climate. Such a leaf period as  $2\frac{1}{2}$  years in a deciduous tree must surely be very exceptional, though individual leaves of lesser evergreen trees and shrubs in the shade of rain-forest may not infrequently last as long as this.

### Trees with leaf-periods between 6 and 12 months

A number of trees have shown regular periods of less than a year; these are as follows, with the exception of those having a six-month period, which are considered separately below.

<i>Species</i>	<i>Period (months)</i>	<i>s.d.</i>		<i>No. of periods</i>
<i>Adenanthera pavonina</i> ..	7.25	.74	or 10.2%	16
<i>Cassia fistula</i> A	9.1	.93	10.2%	15
<i>Cassia fistula</i> B	10.5	1.26	12.0%	8
<i>Cassia fistula</i> C	9.6	.84	8.7%	14
<i>Cassia nodosa</i> (1928-35)	11.7	4	3.4%	7
<i>Cratoxylon formosum</i> A	9.1	1.09	12.0%	15
<i>Cratoxylon formosum</i> B	9.1	.74	8.1%	15
<i>Delonix regia</i> ..	8.8	.94	10.7%	11
<i>Ficus variegata</i> A	6.5	.84	12.9%	20
<i>Ficus variegata</i> B	6.4	.85	13.3%	19
<i>Ficus variegata</i> C	6.1	.65	10.7%	9
<i>Ficus variegata</i> D	6.1	.62	10.1%	13
<i>Lagerstroemia flos-reginae</i> , north side ..	9.2	.88	9.6%	13
<i>Lagerstroemia flos-reginae</i> , south side ..	8.9	.77	8.7%	13
<i>Lagerstroemia flos-reginae</i> old tree ..	9.4	.99	10.5%	13
<i>Salmalia malabarica</i> A	10.5	.44	4.2%	13
<i>Salmalia malabarica</i> B	9.3	.98	10.5%	12
<i>Sterculia macrophylla</i> Pg.	6.9	—	—	4
<i>Sterculia macrophylla</i> S.	7.0	—	—	4
<i>Sterculia</i> sp. ..	10.1	1.26	12.5%	15

It will be noted that nearly all of these trees have a coefficient of variation of about 10%. It is notable that one of the two exceptions, namely the tree of *Cassia nodosa* with a coefficient of only 3.4% in the period 1928-35, showed subsequently a very irregular behaviour. This is discussed further under the heading of irregular trees.

Apart from the indication that a considerable number of deciduous trees have regular periods independent of the climatic cycle, the most interesting feature of the above table is the comparison of different trees of the same species.

In the case of *Salmalia malabarica* the tree with the more regular period is the more vigorous. This species is interesting as being the only one that has a considerable obligatory resting period; such trees are often intolerant of the Singapore climate. The standard deviations of the three trees of *Cassia fistula* are also in the order of their vigour, the most vigorous showing the least deviation. This may be partly connected with the fact that in this species no exact date for leaf-renewal can be given, the process being slow and not always uniform all over the tree; the observer is therefore liable to greater variation in recording dates for the less vigorous trees. There is an indication that some trees of this species in Singapore have a period of 12 months.

The two trees *Cratoxylon formosum* are in different localities, and have never changed simultaneously, but both have a period of 9.1 months. One tree has a substantially greater variation than the other, though both are equally vigorous and of about the same size. It is to be noted that this species appears to have a period of 12 months in the more seasonal climate of Penang.

The four trees of *Ficus variegata* are of considerable interest, as they come very near the six-month trees. It is clear however that trees A & B, which have been longest under observation, have a period significantly longer than six months, and also a rather high standard deviation, whereas the three six-month trees appear to have a low standard deviation. As pointed out below, however, observation must be carried out over a longer period of years if a true picture of their behaviour is to be obtained.

The two trees of *Lagerstroemia*, like those of *Cratoxylon*, are situated some distance apart, have almost equal periods, and do not change simultaneously. The tree of which the two halves have different periods is considerably younger than the other.

The *Sterculia macrophylla* at Penang is interesting as showing a period of seven months in the much more seasonal Penang climate. A second Singapore tree seems

to have a considerably longer period; but it has not been observed long enough since its treatment of cultivation and manuring to allow of a definite statement being made.

### Six-month trees

A few species of trees have a regular period of six months. There are indications that in some cases trees of *Peltophorum* have longer periods than this, but in the cases observed the trees were either young or in poor condition or affected with insect pests. The list of trees observed in the six-month class is as follows:—

	s.d.	c.v.	Mean dates		No. of periods
<i>Couroupita</i>					
<i>guianensis</i> ..	43	72%	15 Mar.	20 Sept.	16
<i>Peltophorum</i>					
<i>pterocarpum</i> ..	43	72%	12 Feb.	10 Aug.	22
<i>Terminalia</i>					
<i>catappa</i> ..	64	105%	8 Feb.	11 Aug.	22

It is remarkable that the exotic *Couroupita* has been more regular than the local *Terminalia* in its behaviour. The dates February–March and August–September for leaf-change follow closely the periods of incidence of the driest weather and are probably controlled by these periods.

### Deciduous trees with no regular leaf-periods

There is probably no very sharp distinction between this class and that of the regular trees, the gap being bridged by those which have high standard deviation. The irregular trees here considered are in fact those which are most affected by small climatic changes, which in Singapore are of irregular occurrence. The most remarkable of the irregular trees under observation are *Cassia nodosa*, *Dyera costulata*, *Ficus caulocarpa*, *Hevea brasiliensis*, *Mangifera indica*, *Sindora Wallichii*, and *Sterculia carthagenensis*. Each of these presents some peculiar features, which are discussed under the appropriate headings below. The most striking may be mentioned here. *Cassia nodosa* showed a very regular period of 11·7 months for several years, and then behaved very irregularly. *Ficus caulocarpa* is the most irregular of all, and I cannot trace any connection between its behaviour and climatic change. *Hevea* trees mostly lose some leaves, and sometimes all, when there is dry weather, but the single tree with a regular period of 13·3 months is a notable exception. *Sterculia carthagenensis* is a very interesting case, discussed below in some detail.

It has been clearly shown by Schweizer's experiments that *Hevea* leaves have a minimum life of about 5 months; and it is probable that most other irregular trees have similarly a minimum period for which the leaves must be retained, the leaves being liable to fall in any dry weather after they have attained this minimum. There is probably always considerable variation from tree to tree in this class, according to the individual nature of the trees, their position (soil, exposure etc.) and previous history.

### Flowering of Deciduous and Evergreen Trees

The flowering of deciduous trees always takes place at a definite point in the leaf-cycle; on the old wood before new leaf growth (*Erythrina indica*), simultaneously with the growth of new leaf shoots (*Cratogeomys formosum*, *Cassia fistula*), or at the end of the new leafy shoots (*Lagerstroemia*, *Peltophorum*). Flowering may be much or little, or even often absent in some cases (*Homalium*, *Terminalia subspatulata*). The extent of flowering depends no doubt on the climatic conditions at the time the flower buds are formed. It is notable that *Delonix* trees flowering in Singapore at some seasons are much fuller of flowers than those flowering at other seasons. In some species, on the other hand, flowering is very much the same whatever the season (*e.g.* *Lagerstroemia*) and there is probably in all cases some difference in response according to innate differences from tree to tree. But whatever these differences in response, flowering always occurs at a definite point in the leaf-cycle, and cannot occur at any other time. From this it follows that, with trees having a leaf-period of less than 12 months, there is no definite flowering season, and little response to climatic change, but a sporadic flowering of individual trees throughout the year.

The flowering of evergreen trees, on the other hand, is usually not dependent on the leaf-cycle, and bears no relation to new leaf growth. Flowering is dependent on dry weather, but the intensity of drought needed to produce flowering, and the time which elapses between the onset of dry weather and the opening of flowers, vary greatly from species to species. Examples are given under *Saraca taipingensis* and *Fagraea fragrans*. Some evergreen trees however flower at the end of new leaf-growth (*e.g.* *Eugenia grandis*, *Cinnamomum iners*).

Evergreen trees produce new leaf-growth at intervals of a few months (sometimes as much as a year or more), the intervals apparently much less regular than the leaf-periods of most deciduous trees. The old leaves usually do not fall as soon as the new have grown, but remain

on the tree for some time afterwards, their total life-period being often very long. There are however cases rather intermediate between the normal deciduous and evergreen types, such as *Dyera costulata* and *Eugenia grandis* (see my 1931 paper, p. 191). Probably in most cases new leaf growth of evergreen trees is dependent on some climatic stimulus, often rainy weather; but little information on this point is available. Some data will be found below under *Mangifera foetida* and *Saraca taipingensis*.

### Statistical significance of the records

In all cases the mean leaf-period has been calculated, and where the number of observations is sufficient, the standard deviation, which is the usual measure of variability. This is calculated by taking the difference of each leaf-period from the mean, squaring these differences, dividing their sum by  $n-1$  ( $n$  being the number of periods) and taking the square root of the result. If one date of a series has been missed, the double period is divided, and two equal periods entered for calculation of differences from the mean, but the sum of the squares is divided by  $n-2$  instead of  $n-1$ .

As noted above, it appears that standard deviation, when expressed as a percentage of the mean period, gives a measure of the susceptibility of a tree to climatic influences. It is notable that in two instances (*Cassia fistula* and *Salmalia malabarica*) a more vigorous tree has a smaller deviation than a less vigorous tree of the same species, indicating that a more vigorous tree is less susceptible to climatic influence. It may be that the more vigorous tree, having a larger and more widely spreading root-system, has access to a larger amount of soil moisture, and is correspondingly less affected by a period of dry weather.

I am grateful to Dr. E. J. MASKELL for advice concerning the data presented in this paper, and for making a statistical comparison of some of them, to assess their significance. The results of this treatment of a few of the records, summarized in the following paragraphs, will give a general idea of the significance of the records as a whole.

Taking two trees which have leaf-periods of more than a year, namely *Hevea braziliensis* and *Sterculia macrophylla*, calculation indicates that the probability in either case that the figures presented show chance behaviour of trees whose true period is 12 months, is less than .01. That is, the probability that these trees have a natural period of more than 12 months is very high.

Taking pairs of trees of the same species which have shown different mean periods, the following results were found. In the case of *Salmalia malabarica*, the probability that the differences observed between the two trees are a chance result is less than .02; this indicates that the differences observed are fully significant. In the case of the two trees of *Cedrela Glaziovii*, the probability is greater than .02, but less than .05; this also indicates a significant difference. In the case of *Ficus variegata*, however, comparing trees A and B, A and C, the differences are found not to be significant. In these trees, the mean periods are near together, and the deviations rather high, so that a longer period of observation is needed to indicate significant differences between them.

It should be noted however that though the differences between a pair of trees such as the two *Salmalias* may be significant, this does not necessarily indicate that the whole difference is due to the individual natures of the trees. A tree with good soil and other favourable environmental factors may be more vigorous than a tree less favoured, and the two might on that account show some difference of leaf-period. On this point, we have no evidence. All we can say is that in an identical climate two trees of the same species may show a significant difference of behaviour, part of this being presumably due to innate differences between the two trees and part to differences of soil conditions and other topographical factors. In the case of the two *Cedrela* trees, the differences of soil and topography appear to be negligible, but one cannot be entirely sure of this. An appropriate experiment would be to propagate the two trees vegetatively, and observe whether the offspring, planted together in a different place, continued to show the differences of their parents.

### Conclusion

The observations presented in this paper indicate clearly that the climate of Singapore is so uniform on the whole that many trees change their leaves at intervals which have no relation, or little relation, to climatic change. It is clear however that there is much variation in regularity of behaviour among such trees, even between different individuals of the same species. One can find all conditions from trees with very high constancy of period (the period bearing no relation to the calendar year) to trees that are so susceptible that they may renew at least some of their leaves at any small climatic change.

The constant-period trees appear to be organized on the principle that their leaves are efficient for a certain

period, and are then shed and renewed, whatever the season. For these trees, no climatic change experienced in Singapore is sufficient to make them change their leaves much earlier or later than their proper period, which is dependent on the nature of each tree, and perhaps also on its soil conditions or other local factors. However, trees of these same species in climates with long dry seasons may change their leaves at intervals of exactly a year. It is the climatic uniformity of Singapore which permits such trees to show their individuality; in the interplay of internal and external factors, the internal are here by far the stronger.

At the other extreme are trees which are considerably affected by such climatic changes as do occur in Singapore. As such changes are very irregular over a great part of the year, trees of this kind are irregular in behaviour. They appear to be organized on the principle that their leaves have a *minimum* life; any dry period occurring after the minimum may cause some leaves to fall, with subsequent leaf-renewal. There is no sharp distinction between these trees and those which have constant leaf-periods; the gap is bridged by trees showing varying degrees of deviation from regular periods.

Another point to observe, deserving of future attention, is that interference with the roots of trees may completely change the rhythm of their leafy shoots. It seems likely that stimulation of roots at a sufficient interval after the last new leaf-growth will stimulate new leaf-growth, followed by fall of the old leaves; but that the reaction will depend on the age of the last leaf-growth, much in the same way that Hevea leaves have a minimum life. But different trees will doubtless behave in different ways, and much of interest may emerge from watching their reactions.

Evergreen trees differ from deciduous trees in not losing their old leaves when new ones are produced; the growth of new leaves is not a consequence of the loss of the old, and must be due to some other stimulus. Observations on the behaviour of evergreen trees are few (see *Mangifera foetida*, in this paper), but I think they also will be found to vary in their response to climatic stimulus. It is clear that some (e.g. *Saraca*) are stimulated by wet weather to produce new leaves, and that such production comes at irregular intervals. The length of such intervals and their dependence or otherwise on climatic stimulus probably vary as much from species to species as in the case of deciduous trees. A further important point of difference between evergreen and deciduous trees is that in the former flowering is usually independent of vegetative growth, whereas in the latter flowering always comes at a definite point in the leaf-cycle.

## Records of Individual Trees\*

### Adenanthera pavonina L.

The tree reported on in 1931 has been under continuous observation since that time, and has maintained an average leaf-period of 7.25 months, with a standard deviation of .74 month over 16 periods. The longest period was 8.4 months and the shortest 6.2; both these occurred in the records formerly reported. Leaf-renewal has occurred in every month of the year except February, June and November.

Leaf-renewal after the 8.4 month period occurred towards the end of a 2-month drought; if this prolonged dry weather was the cause of deferring leaf-renewal, it is difficult to see why leaf-renewal after the short period of 6.2 months took place at the end of one month's dry weather. In both cases the new leaves developed before any considerable rainfall had broken the drought. A subsequent record of leaf-renewal on 9th July, 1938 gives an average of about 7.5 months for two leaf-periods after 11th April, 1937.

It should be noted that this species is said to be annual in its behaviour at Peradeniya, losing its leaves towards the end of the year. On a recent visit which I paid to Colombo in October, I noticed that all trees were in old leaf with ripe fruits, and the same appeared to be the case at Bombay a few days later. See however remarks under *Peltophorum ferrugineum*.

The following table gives dates of leaf-renewal, with the length of each leaf-period, and also the standard deviation as calculated from these figures.

Months				Months			
27. 8.27	..	..	—	15. 1.33	..	..	8.2
22. 3.28	..	..	6.8	6. 9.33	..	..	7.7
21.10.28	..	..	7.0	April 1934	..	..	7 +
28. 4.29	..	..	6.2	1.12.34	..	..	7 +
8.12.29	..	..	7.3	15. 7.35	..	..	7.5
21. 8.30	..	..	8.4	1. 3.36	..	..	8.5
10. 3.31	..	..	6.6	10.10.36	..	..	7.3
4.10.31	..	..	6.8	11. 4.37	..	..	6.0
8. 5.32	..	..	7.1				

16 Periods.

Mean period: 7.25 months.

Extremes: 8.4 and 6.2 months.

Standard deviation: .74 month or 10.2%.

### Anisoptera megistocarpa van Sl.

A large tree of this species in the Gardens Jungle has been under observation since 1928; it has shown considerable variation in behaviour, with long leaf-periods

\* In the records which follow, dates of leaf-renewal are the dates on which leaf-buds were seen to be starting new growth.

throughout. The tree is slowly deciduous during many weeks, new growth appearing when it is almost bare of leaves. It has had six periods varying between 12 and 16.5 months, and two much longer periods of 23.8 and 28.2 months. The crown of the tree is clearly visible from my house, though distant, and I am confident that these two long periods represent intervals between new growth following bare phases. It is possible however that (as with the tree of *Dyera*) new growth may have occurred without a preceding leaf-fall during these long periods; I might have missed such new growth, as there is little colour change between new and old foliage. If we assume that the long periods are in fact double periods (so far as new growth is concerned), we find that the standard deviation is 12%, which is no greater than in a number of other trees; taking them as single periods, the standard deviation is very high.

In any event, more observation is needed to understand the behaviour of this tree. One cannot see any relation between the dates of leaf-renewal and rainfall. Leaf-renewal in March, 1931, March, 1932 and April, 1933 took place after rather dry weather in February (average 115 mm.) which was absent in 1935; but if a dry February causes leaf-renewal, it is curious that the much drier month of February, 1936 (43 mm.) had not a more immediate effect. The dates of new leaf-growth, and the intervals in months between them, were as follows.

Months				Months			
18.	8.28	..	..	—	2.	6.34	.. .. 14.0
8.	12.29	..	..	15.7	27.	5.36	.. .. 23.8
12.	3.31	..	..	15.1	15.	10.37	.. .. 16.5
13.	3.32	..	..	12.0	22.	2.40	.. .. 28.2
1.	4.33	..	..	12.6			

Reckoning the periods 23.8 and 28.2 as double periods (i.e. as  $2 \times 11.9$  and  $2 \times 14.1$  months respectively), we have the following:—

10 periods; mean period 13.8 months,  
extremes 12.0 and 16.5 months.  
Standard deviation: 1.65 months or 12.0%.

### ***Caesalpinia ferrea* Mart.**

A single tree of this south American species, apparently the only mature tree of its kind in Singapore, grows in the Botanic Gardens. It has made vigorous growth, and is very handsome, but flowers poorly and sets very few fruits. The tree is deciduous, its leaf-fall taking place slowly over a period of several months. Before all the leaves are gone, new growth appears on isolated twigs (as in *Cassia nodosa*), but general new leaf growth, which is very rapid when it does occur, is deferred until practically all old

leaves are gone. The dates given are for the occurrence of general new leaf growth, and are therefore less precise than those given for some other trees.

An isolated observation of this tree was made in 1929; continuous records date from 1934. The gap in observations is exactly four times the mean period for 1934–1940. For the years 1934–1940, the standard deviation is below 10%, so it is fairly clear that this is a tree with a period of more than 12 months. A few seedlings have now been obtained from it, and their development will be watched with interest. The following are the observed dates of general leaf-renewal.

<i>Months</i>			<i>Months</i>		
25.8.29	..	.. —	26.9.37	..	.. 14.5
23.5.34	..	4 × 14.2	1.1.39	..	.. 15.2
19.6.35	..	.. 12.9	22.4.40	..	.. 15.7
12.7.36	..	.. 12.8			

For the years 1934–1940 (5 periods) we have:—

Mean period: 14.2 months.

Standard deviation: 12 months or 85%.

### **Canarium rufum Benn.**

This local tree has been under observation only since 1935. It appears to have a 12-month period. It is on the edge of the Gardens jungle, growing under good conditions. Leaf-fall is rather sudden, and leaf-renewal takes place as soon as the tree is bare. New leaf buds have opened on the following dates.

<i>Months</i>			
1.5.35	..	.. —	Mean leaf-period: 12.0 months.
20.5.36	..	.. 12.6	Standard deviation: .65 month
4.6.37	..	.. 12.5	or 5.4%.
20.4.39	..	2 × 11.3	Mean date: 9 May.
30.4.40	..	.. 12.3	

### **Cassia fistula L.**

The two trees mentioned in 1931 have been under observation since that time, and also a third tree. The two former trees have latterly both shown signs of lack of vigour, but the third tree is very vigorous and has flowered heavily on all occasions. As noted previously, it is not easy to fix an exact date for leaf-renewal of trees of this species; the dates are therefore subject to a greater margin of error than most of the other observations recorded in this paper. The tree B showed such a slow change that no observations on it were made after 1935. A fourth tree lately brought under observation near the others has had one period of 10.6 months.

Two exceptionally large and vigorous trees at Government House, Singapore, have renewed their leaves and flowered in May or June in the following years: 1928, 1931,

1938, 1939. It seems likely that these trees have a period very nearly of 12 months. It is evident therefore that observations on further trees are desirable.

The dates of leaf-renewal of the three trees for which the longest observations are available, with other data, are as follows:

A			B			C		
		Months			Months			Months
11.12.27	..	—	8. 3.28	..	—	11.12.27	..	—
11. 9.28	..	9.0	13. 1.29	..	10.2	28.10.28	..	10.6
1. 6.29	..	8.7	24.11.29	..	10.4	22. 2.31	3 ×	9.3
1. 3.30	..	9.0	10. 9.30	..	9.6	13.12.31	..	9.7
1.12.30	..	9.0	25. 5.31	..	8.5	27. 8.32	..	8.4
29. 8.31	..	8.9	8. 5.32	..	11.5	28. 6.33	..	10.0
8. 5.32	..	8.3	16. 5.33	..	12.3	Mar. 1935	2 ×	10.5
1. 3.33	..	9.8	10. 3.35	2 ×	10.9	10. 1.36	..	10.0
29. 3.35	3 ×	8.3	Mean period: 10.5			4.10.36	..	8.8
26. 2.36	..	10.9	months.			28. 6.37	..	8.7
early			Standard deviation:			May 1938	..	10.0
Jan. 1937	..	10.5	1.26 months or 12.0%.			26. 2.39	..	9.0
Oct. 1937	..	9.5				Mean period: 9.6		
5. 4.39	2 ×	9.0				months.		
Mean period: 9.1						Extremes: 8.4 and		
months.						10.6 months.		
Extremes: 8.3 and						Standard deviation:		
10.9 months.						.84 month or 8.7%.		
Standard deviation:								
.93 month or 10.2%.								

### **Cassia nodosa Buch.-Ham.**

The tree mentioned in 1931 continued its leaf-renewals after slow and prolonged leaf-fall in the early part of the year, tending to become earlier each year up to 1935, for which the date recorded is 10 March. The dates given are for general new growth of leaf buds, and are usually about a month later than the first new buds which develop here and there on small branches in advance of the remainder of the tree. The standard deviation for this period is remarkably low.

Then in December, 1935, possibly as a result of the rather dry period from July to October, about  $\frac{3}{4}$  of the branches on the tree produced new leaves. The remaining branches did not bear new leaves until March, 1936. The branches which had new growth in December, 1935 renewed their leaves again in July, 1936. In April, 1937 all branches renewed their leaves.

This tree is said to have been produced from a seed from Pahang, where the species is common, and leaf-renewal with flowering is general about May. It appears likely that the more uniform climate of Singapore has allowed our tree to show a tendency to instability or to sensitiveness to climatic changes. A number of young trees of this species have lately been planted, and their behaviour will

be watched with interest. Data for the period 1928-1935 are given below.

	Months			
28.5.28	..	..	—	
15.5.29	..	..	12.1	
15.4.30	..	..	11.0	Mean period: 11.7 months.
12.4.31	..	..	11.9	Extremes: 11.0 and 12.1 months.
16.4.32	..	..	12.1	Standard deviation: .4 month
9.4.33	..	..	11.8	or 3.4%.
20.3.34	..	..	11.4	
10.3.35	..	..	11.7	

### *Cedrela Glaziovii* C. DC.

The trees of this species were wrongly ascribed to *C. toona* in my 1931 paper. These two trees have been under observation since that time and have shown a remarkable difference in behaviour. Both are tall vigorous trees growing near together under good soil conditions. They behave alike in their slow leaf-fall, from the top downwards, and the appearance of new leaves first on the top branches after the whole tree is bare. One tree has had a mean leaf-period of 12.5 months, advancing its time of leaf-fall from July to December during the period under review, with a very small standard deviation. For the first few years it appeared likely that this tree had a period of exactly 12 months, but it now seems more likely that there is a significant departure from this figure.

The other tree has shown less regularity (though its coefficient of variation is only 12%), and has throughout had leaf-periods decidedly more than 12 months, with a mean of 14.0. Most of the periods have been 13 to 14 months, but one was 17.7. This long period included the whole of 1932, the driest year in the period 1927-38. For other cases of difference of behaviour between trees of the same species, see *Ficus variegata*, *Hevea* and *Peltophorum*.

The following table shows how one tree had ten leaf-periods and the other only nine, in the same period of years.

Months				Months			
8. 7.28	..	..	—	Aug. 1928	..	..	—
4. 8.29	..	..	12.9	Sept. 1929	..	..	13.
30. 7.30	..	..	11.9	end Sept. 1930	..	..	12.5
1. 8.31	..	..	12.0	13.12.31	..	..	14.7
9. 8.32	..	..	12.3	4. 6.33	..	..	17.7
13. 8.33	..	..	12.1	July 1934	..	..	13.
10. 8.34	..	..	11.9	12. 8.35	..	..	13.
10. 8.35	..	..	12.0	Oct. 1936	..	..	14.
12. 9.36	..	..	13.1	end Oct. 1937	..	..	12.5
12. 9.37	..	..	12.0	2.12.38	..	..	13.1
17.10.38	..	..	13.2	19. 4.40	..	..	16.6
15.12.39	..	..	14.0	10 periods: mean period 14.0 months.			
11 periods: mean period 12.5 months.				Extremes: 12.5 and 17.7 months.			
Extremes: 11.9 and 14.0 months.				Standard deviation: 1.7 months			
Standard deviation: .70 month or 5.6%.				or 12.1%.			

***Ceiba pentandra* (L.) var. *caribaea* (DC) Bakh.**

A tree of this variety (the West Indian Kapok), received as a stump from Buitenzorg and planted in October 1933, has shown a six-month leaf-period since 1936. The new leaves appear before the old have quite fallen; the change was very gradual in September, 1938 and March, 1939. Observed dates (incomplete) of new leaf production were:

8. 4.36	Sept. 1938
27.10.36	March 1939
25. 4.37	March 1940
15.10.37	Sept. 1940

Another tree of the same origin, planted at another place but at the same time, renewed its leaves on 28th December, 1936, 1st June, 1937, 9th February, 1939 and 26th July, 1939. It has thus shown a similar six-month period, but has changed its leaves at different times from the first tree. The reason is probably that this tree was cultivated and manured some time after planting (the first tree has never had such treatment), but the date of this treatment was not recorded. For a similar case, see *Kigelia*.

A seedling raised from seed from the Gold Coast has also shown a six-month period. *Ceiba pentandra* in Java has a twelve-month period. Possibly these young trees will lengthen their period as they grow older.

***Couroupita guianensis* Aubl.**

An old tree of this species was reported as having three six-month periods in 1929-1931. A record over 16 periods is here presented, the average being still exactly six months and the standard deviation identical with that of the tree of the local species *Peltophorum pterocarpum*. Leaf-fall is very rapid, and also leaf-renewal; the dates given are therefore closely comparable. The tree is only bare for a day or two.

A young tree, planted in 1925 in a thicket among other trees which restricted its growth, did not behave at all regularly at first, but it appears to be settling down to a more regular rhythm as it grows older; it now has its crown clear of other trees and is growing more vigorously, but has not yet begun to flower. It does not change its leaves at the same time as the old tree.

In *De Tropische Natuur*, XXIII (1934), p. 244, it is recorded that the *Couroupita* trees at Buitenzorg change their leaves in March-April and September-October, thus

agreeing with the old Singapore tree. Mr. Ahmadi, Superintendent, Municipal Gardens, Bombay, informs me that the Couroupita trees in the Victoria Gardens, Bombay, change their leaves regularly in March and October. This regularity of behaviour in such different climates is remarkable.

The observed dates of leaf-renewal of the young tree in Singapore were as follows:

<i>Months</i>				<i>Months</i>			
19. 4.32	..	..	—	9. 7.36	..	..	7.9
7. 1.35	..	..	8.5	25. 1.37	..	..	6.5
27. 1.34	..	..	12.7	20. 7.37	..	..	5.9
23. 5.35	..	2	× 7.9 ?	15. 8.39	..	4	× 6.2 ?
13.11.35	..	..	5.7	22. 2.40	..	..	6.2
				18. 8.40	..	..	5.9

The data for the old Singapore tree are as follows.

<i>Months</i>				<i>Months</i>			
15. 9.29	..	..	—	8. 9.33	..	..	5.6
23. 3.30	..	..	6.3	19. 3.34	..	..	6.4
16. 9.30	..	..	5.8	7. 9.34	..	..	5.6
22. 3.32	..	..	6.1	12. 3.35	..	..	6.2
18. 9.31	..	..	5.9	15. 9.35	..	..	6.1
5. 3.32	..	..	5.6	25. 3.36	..	..	6.3
10. 9.32	..	..	6.2	5.10.36	..	..	6.4
19. 3.33	..	..	6.3	17. 4.37	..	..	6.4
				12. 9.37	..	..	4.8

16 periods.

Mean period: 6.0 months.

Extremes: 4.8 and 6.4 months.

Standard deviation: .43 month or 7.2%.

Mean dates: 15 March and 20 September.

### **Cratoxylon formosum (Jack) Dyer.**

Two trees of this species, in different parts of the Botanic Gardens, Singapore, have been kept under observation from 1927 onwards. As shown below, their periods have been closely similar, and on the whole very regular, averaging about 9 months, but the trees are quite apart in their dates of leaf-renewal. The behaviour of these trees is in my opinion one of the most remarkable examples in the series of observations recorded in this paper.

A tree of this species in the Waterfall Gardens, Penang, has been noted by me during visits in January and February 1931, 1932, 1933, 1935, 1936, 1937 and 1939. In each of these years the tree has renewed its leaves about the end of January (*i.e.* in the dry season). It is possible of course that this species is one that varies considerably in its leaf-periods from tree to tree, but the difference of behaviour in the seasonal climate of Penang seems to me likely to be significant.

The dates of leaf renewal of the Singapore trees have been as follows.

A				B			
			Months				Months
1.	9.27	..	—	6.	2.28	..	—
10.	6.28	..	9.3	21.	10.28	..	8.5
17.	3.29	..	9.2	30.	6.29	..	8.3
23.	2.30	..	11.2	7.	4.30	..	9.2
27.	9.30	..	7.2	12.	1.31	..	9.2
1.	8.31	..	10.1	11.	10.31	..	9.0
1.	4.32	..	8.0	3.	8.32	..	9.7
11.	12.32	..	8.3	16.	4.33	..	8.4
13.	9.33	..	9.1	1.	2.34	..	9.5
end June 1934	..	..	9.4	30.	12.34	..	10.9
25.	3.35	..	9.0	12.	9.35	..	8.5
16.	11.35	..	7.7	26.	5.36	..	8.5
20.	9.36	..	10.1	8.	3.37	..	9.4
19.	7.37	..	10.0	2.	10.38	..	2 × 9.4
8.	3.39	..	2 × 9.9	10.	7.39	..	9.3
Mean period: 9.1 months.				Mean period: 9.1 months.			
Extremes: 7.2 and 11.2 months.				Extremes: 8.3 and 10.9 months.			
Standard deviation: 1.09 month or 12.0%.				Standard deviation: .74 month or 8.1%.			

### *Delonix regia* (Boj.) Raf. (*Poinciana regia* Boj.).

An old tree of this species was under observation between 1928 and 1936, over eleven leaf-periods. As noted in my earlier paper, leaf-renewal is slow, and it is impossible to give accurate dates, or dates which are strictly comparable from one leaf-period to another. It is however evident that the mean period of the tree is in the neighbourhood of 9 months. After a lapse of 3 years without observations the tree was noted as in new leaf in June, 1939, which agrees with the last observations of July, 1936 (4 periods of 8.8 months occupying 2 years 11 months).

Trees of *Delonix regia* are commonly planted in Singapore, but even those planted simultaneously do not always keep in step together. It takes them a few years to develop a regular leaf rhythm, and this may perhaps change gradually with the age of the tree. Observations on this point, made on a group of young trees planted together, would be of great interest. It would be necessary however to treat all trees alike as regards cultivation (*see Kigelia*).

As noted in my earlier paper, some *Delonix* trees may be seen in flower at any time of the year in Singapore, but it appears that at some seasons flowering is more abundant than at others. Possibly the climatic conditions at the time when flower buds are produced may be responsible for this; *i.e.* it may be that trees which are bare during wet weather produce fewer flower-buds than those which are bare during dry weather. There is however no proof of this. At

Penang a Delonix tree renewed its leaves in January, 1931, 1932 and 1933. Further Penang records are desirable. The Singapore tree has renewed its leaves as follows.

Months				Months			
24. 6.28	..	..	—	Jan. 1933	..	..	10.
30. 3.29	..	..	9.2	Aug. 1933	..	..	8.
22.12.29	..	..	8.7	Mar.-Ap. 1934	..	..	8
10.11.30	..	..	10.6	Jan. 1935	..	..	8
1. 7.31	..	..	7.7	Sept.-Oct. 1935	..	..	8
March 1932	..	..	8.	July 1936	..	..	9
Mean period: 8.8 month.							
Standard deviation: .94 month or 10.7%.							

### *Dyera costulata* Hook. fil.

As reported in 1931, two trees of this species have been under observation. Leaf-renewal tends to be at rather irregular intervals, somewhat as in *Hevea*. On the big tree, which has two main trunks, leaves are sometimes renewed on a few branches only, or on one main branch system, between general renewals. New leaf growth occurring in the wet season (October, November) has in all cases preceded fall of the old leaves; at other times the old leaves have fallen before the new leaves began to unfold.

The big tree has had complete leaf-changes at intervals of from 3 to 11 months, sometimes with partial changes in between. Out of the 18 such periods, 9 have been about 6 months, 4 considerably less than 6, and 5 considerably more. A comparison with rainfall records indicates that there is some tendency for leaf-fall to follow dry weather; but this does not invariably occur. As above remarked, new leaves sometimes appear before the old leaves have fallen; in four such cases (all those noted) the period since the preceding leaf-fall was almost exactly six months. In other cases, under apparently similar conditions, no leaf-renewal has been recorded, and the old leaves appear to have persisted for 10 or 11 months (1931-32, 1934-35 and 1938-39). Where new leaves appear before leaf-fall, the old leaves are always shed within about two weeks following.

The smaller tree under observation (with one trunk) has changed its leaves rather regularly each year about March-June. In 3 years (1928, 1929, 1932) it has also changed again about six months later, but so far as my observations go, this has not occurred in other years. Taking only the changes in March to June, the mean period is 12.3 months, and the standard deviation .84 month (6.8%). This tree also occasionally produces new leaves on a few branches without a general renewal. When new leaf growth was general in November, 1932 it was not preceded by leaf fall.

Dyera trees are fairly frequent in the Gardens Jungle, and they tend to change their leaves at the same time, though they do not always behave alike. The two trees under observation have changed their leaves simultaneously (or approximately so) on the majority of occasions, but on others have been curiously diverse in behaviour. The following are dates of general changes only.

Large Tree			Small Tree		
		Months			Months
6. 9.27	..	—	17. 3.28	..	—
17. 3.28	..	6.4	11. 9.28	..	5.7
14. 6.28	..	2.9	14. 4.29	..	7.1 12.9
6. 4.29	..	9.7	3.11.29	..	6.7
20.10.29	..	6.5	25. 5.30	..	6.7 13.3
25. 5.30	..	7.2	1. 6.31	..	12.2
1.10.30	..	4.2	22. 5.32	..	11.7
2. 6.31	..	8.0	3.11.32	..	5.4
12. 4.32	..	10.3	21. 4.33	..	5.6 11.0
20.10.32	..	6.3	21. 5.34	..	13.0
7. 8.33	..	9.5	25. 4.35	..	11.1
21. 5.34	..	9.5	4. 5.36	..	12.3
3. 5.35	..	11.4	14. 5.37	..	12.3
9.11.35	..	6.2	23. 6.38	..	13.3
31. 5.36	..	6.7			
3.12.36	..	6.1			
3. 6.37	..	6.0			
25. 9.37	..	3.7			
23. 6.38	..	8.9			

### **Erythrina lithosperma** Miq.

Trees of this species in Singapore are remarkably constant in flowering in December and January, towards the end of the wet season. The trees are not deciduous, but this flowering appears to be connected with new vegetative growth which takes place early in the wet season, the onset of which is rather regular about October. I have no full record of the behaviour of one of these trees throughout the year, and only enter this observation here as the flowering of *Erythrina lithosperma* is one of the most regular seasonal phenomena in Singapore. The trees are not very showy nor abundant.

### **Fagraea fragrans** Roxb.

As reported in this Bulletin, Vol. IX pp. 73-78 (1935), trees of this species, which are abundant in Singapore, flower gregariously about May every year. The trees are evergreen, and their vegetative growth is practically continuous, but their flowering is such a regular phenomenon that it should be mentioned here. The height of the flowering period, which lasts about 2-3 weeks, occurs

approximately four months after the end of the wet season, when the first dry period occurs. A week of dry weather, with no more than about .1 inch of rain, following much wetter weather, appears to stimulate the formation of flower buds. Fruits ripen about  $3\frac{1}{2}$  months after flowering. There tends to be a small flowering about October–November, but this is irregular, and a few flowers may occur on isolated trees also at other times, but no general flowering of all trees.

### **Ficus caulocarpa** Miq.

The tree reported upon in 1931 (under the name *F. glabella*) has been under observation since that time and has renewed its leaves three times each year, except 1935 and perhaps 1938, in which it changed four times. The causes of the length of the individual periods are doubtless complex, but it is fairly clear in a few instances that distribution of rainfall has had an influence. 1931 was a very wet year, and the long leaf-period was longer than usual; this was probably the cause of an unusually late first change in 1932. In 1934 December was unusually dry, and this probably accelerated the first change in 1935; but why the next period should have been so very short is not at all clear. In several years there is a definite succession of periods, approximately to 3, 4 and 5 months, but in other years this succession is much less distinct. The mean dates of leaf renewal (1928–37), are 12 February, 9 June and 8 November (giving intervals of 96, 117 and 152 days), the standard deviations being 19, 22 and 17 days; these deviations are distinctly high as compared with those shown by most of the deciduous trees here reported.

The amount of rain falling during a leaf-period bears no relation to the length of the period; I have also compared the rainfall from 14 days before the end of one period to 14 days before the end of the next, but this also shows no correlation with length of period.

Another younger tree, about a mile away, was under observation for a time, but probably not all changes were observed. Leaf-renewal dates were noted for this tree on 7 occasions between November, 1934 and June, 1937. The differences in time between the nearest leaf-renewals of the Gardens tree were 13, 23, 33, 32, 15, 13 and 53 days.

A young plant of the same species, which had started epiphytic growth on an old tree in the Gardens, changed its leaves once simultaneously with the large tree, but on two other occasions at times 40 and 41 days different.

It thus appears probable that the factors controlling leaf-fall and leaf-renewal in this species are complex and

vary from tree to tree. They are certainly not simply related to climatic conditions. It is possible that fruiting may influence the length of leaf-period; it seems to be rather infrequent, and the small figs are not easily observed on the high branches of the Gardens tree. Unfortunately I have no records of fruiting.

The dates of leaf-renewal observed are as follows:—

1927					15 Oct.
1928	.	..	29 Jan.	3 June	4 Nov.
1929	..	..	3 Feb.	17 May	20 Oct.
1930	.	..	23 Jan.	8 June	11 Nov.
1931	..	..	10 Feb.	28 June	2 Dec.
1932	..	..	12 March	1 July	9 Nov.
1933	..	..	16 Feb.	3 July	29 Oct.
1934	..	..	3 Feb.	19 May	2 Nov.
1935	.	..	20 Jan.	7 April	5 Dec.
1936	..	..	24 March	10 July	30 Nov.
1937	..	..	17 Feb.	27 May	20 Oct.
1938	..	..	unrecorded	20 Aug.	31 Dec.
1939	..	..	24 April	27 June	2 Sept.
1940	..	..	25 Jan.	13 June	

### **Ficus variegata Bl.**

This is a common species in Singapore, and seedlings are abundant in the Botanic Gardens. A tree was mentioned in my 1931 paper under the name *F. polysyce*.

This tree appeared at first to have a period of six months, but later proved to have a rather longer period, showing an average of 6.5 months, with standard deviation of .84 or 12.9%. Its most peculiar behaviour was in 1932, when, having renewed its leaves in March, it persisted until November with the next crop of leaves, and then changed again in June 1933, the only leaf-renewal in that year.

A second tree, observed (with two gaps) from 1929 to 1939 was rather less regular, as shown below. Two other trees, observed only from 1932 and 1933, have shown greater regularity, with a less tendency so far to exceed a six months average. Mr. Corner has pointed out to me that the first mentioned tree is a male tree (figs contain male and gall flowers only) and one of the last two trees is female.

It was mentioned in 1931 that the male tree bore six crops of fruits in a year. The females trees under observation bear less frequent fruit crops (3 to 4 in a year), but in neither case could any relation between fruiting and leaf change be noted. The trees are cauliflorous, belonging to the subgenus *Neomorphe*. (For further information on this species, see Corner's paper in Journ. Malayan Branch

R. Asiatic Soc. XI: 48-52. 1933). The dates of leaf-renewal of the four trees and their leaf-periods in months are as follows:—

A				B			
Months				Months			
12. 8.28	..	..	—	25. 8.29	..	..	—
6. 1.29	..	..	4.8	2. 3.30	..	..	6.2
14. 7.29	..	..	6.3	7. 4.31	..	2 ×	6.6
7. 2.30	..	..	6.7	Oct. 1931	..	..	6.
5. 8.30	..	..	6.0	22. 5.32	..	..	7.
8. 2.31	..	..	6.1	23.10.32	..	..	5.0
20. 8.31	..	..	6.4	Feb. 1933	..	..	4.
6. 3.32	..	..	6.5	27. 8.33	..	..	6.
Nov. 1932	..	..	8.	4. 3.34	..	..	6.2
11. 6.33	..	..	7.	18. 9.34	..	..	6.5
26. 1.34	..	..	7.5	31. 3.35	..	..	6.4
6. 9.34	..	..	7.3	Nov. 1935	..	..	7.
15. 3.35	..	..	6.3	June 1936	..	..	7.
Oct. 1935	..	..	7.	20.11.36	..	..	5.
April 1936	..	..	6.	1. 6.37	..	..	6.4
30.10.36	..	..	6.	13.12.38	..	3 ×	6.1
12. 5.37	..	..	6.4	June 1939	..	..	6.
11.10.38	..	3 ×	5.7				
11. 5.39	..	..	7.0				
C				D			
Months				Months			
21. 1.33	..	..	—	9. 8.32	..	..	—
25. 1.34	..	2 ×	6.1	14. 1.33	..	..	5.2
15. 8.34	..	..	6.5	Feb. 1934	..	2 ×	6.5
22. 1.35	..	..	5.2	21. 8.34	..	..	6.
19. 7.35	..	..	6.0	18. 2.35	..	..	6.
11. 2.36	..	..	6.8	6. 8.35	..	..	5.6
Sept. 1936	..	..	7.	22. 3.36	..	..	7.5
March 1937	..	..	6.	Sept. 1936	..	..	6.
end Aug. 1937	..	..	5.	30. 3.37	..	..	6.
				end Sept. 1937	..	..	6.
				30. 9.38	..	2 ×	6.
				13. 3.39	..	..	5.4

Mean periods: A, 6.5; B, 6.4; C, 6.1; D, 6.1 months.  
 Standard deviations: A, .84; B, .85; C, .65; D, .62 month.  
 Coefficients of variation: A, 12.9%; B, 13.3%; C, 10.7%;  
 D, 10.1%.

### *Heritiera elata* Ridl.

A record of a leaf-period of nearly two years for a tree of this species was reported in my former paper. Subsequently there was a gap of four years in observations, and then three more periods, successively of 17, 22 and 20 months were recorded. The tree is usually not bare before new leaf-growth occurs; the new growth is conspicuous because of its pale colour. Flowering occurs on the old wood, usually during the period of new growth, but may perhaps (as with *H. macrophylla*) occur at other times. The tree is a very tall one, remaining from primitive forest. A young tree, about 100 yards away, was observed to make new growth at the same time as the old tree in 1940.

The periods seem rather unequal in length, but the standard deviation is not excessive as compared with other trees. All recorded cases of leaf-renewal have occurred after unusually dry periods. This tree is probably one with a naturally long leaf-period (though the period is less than that of *H. macrophylla*) which is rather much influenced by climatic change occurring towards the end of its normal leaf-period. Observations of leaf-renewal are as follows.

Months				Months			
17. 3.29	..	..	—	March 1935	..	..	—
19. 2.31	..	..	23	Aug. 1936	..	..	17
				1. 6.38	..	..	22
				31. 1.40	..	..	20
Mean period: 20.5 months.							
Standard deviation: 2.6 months or 12.7%.							

### *Heritiera macrophylla* Wall.

A small but quite vigorous tree of this species, which is native in Burma has been under observation since March 1929. It has an exceptionally long leaf-period, more than 21½ years on four successive occasions. Leaf-fall is prolonged over perhaps two months or more, at first slow, then progressively more rapid. Leaf-renewal is quite rapid, and is complete in a few weeks. In one case leaf-renewal took place on one branch after another over a period of six months instead of on all branches together.

It is notable that the Malayan species *H. elata* also has a long leaf-period. It would be interesting to have records of the widely distributed coastal tree *H. littoralis*; also to know something about the behaviour of *H. macrophylla* in its native climate.

The dates of leaf-renewal of the tree of *H. macrophylla*, and lengths of leaf-periods, are as follows.

Months			
30. 3.29	..	..	—
10.12.31	..	..	32
14. 7.34	to Jan. 1935	..	31 (to 37 months)
18. 2.37	..	..	31
30.11.39	..	..	33.4

### *Hevea braziliensis* Muell.-Arg.

The four trees mentioned in my earlier paper have been kept under observation since that time. Three of them illustrate the usual behaviour of *Hevea* trees in Singapore, namely response to dry weather whenever it comes, and consequent irregularity of leaf-renewal. The two larger trees have sometimes changed their leaves completely at the same time; sometimes a complete change

by one tree has been accompanied by a partial change in the other. The summary, printed below, though incomplete, gives a sufficient record to illustrate their behaviour.

One of the young budded trees, recorded in the previous paper as never undergoing a complete leaf change, but always changing leaves on a branch (or a few branches) at a time, continued to behave in the same way for some time afterwards. It was later once observed to change all its leaves simultaneously, but no full records have been kept. It may show a greater tendency to complete change as it grows older.

The other young budded tree, reported in 1931 as having renewed its leaves completely three times, has consistently continued this habit, with a period which appears to be significantly more than 12 months, the mean for nine periods being 13.3 months, with standard deviation of only 6.5%. The leaves of this tree are small, and it may be a morphologically distinct variety.

It is interesting to compare these observations with those of Schweizer (*Mitt. der Naturforsch. Ges. Bern*, 1932, pp. 1-8) at Djambi in Java, where there is a regular dry season. Leaf change of the *Hevea* trees at Djambi is related to the onset of the dry season, but some trees are always earlier or later than others in leaf-renewal. Characters of earliness or lateness are shared by all trees of the same clone. One tree was found to change its leaves frequently, a branch at a time; after manuring with Ammonium sulphate, the leaves all fell together, rather late, at the next dry season, but after two years the tree resumed its irregular habit.

Schweizer defoliated certain trees (the behaviour of which had been previously recorded) at various times in relation to the season of leaf-change. If the trees were defoliated more than 5 months before normal leaf-change, they produced new growth and the next change occurred at the usual time. If defoliation was carried out only 2-3 months before the date of normal leaf-fall, the subsequent leaves remained on the tree up to 3 months after the usual date of change. That is, the minimum life of *Hevea* leaves appears to be 4-5 months.

In Singapore, dry weather is irregular in its occurrence (see introductory remarks in this paper) and it seems probable that any dry period will affect some *Hevea* trees which have leaves more than 4-5 months old. If the dry weather is severe, all the leaves on the tree may fall; if not severe, only the oldest leaves. As there are few budded

trees in Singapore, the behaviour of the trees is very irregular, and after every dry period some trees may be seen with autumn colours or bare branches.

For other examples of irregular leaf-change, see *Sterculia carthaginensis* and *Mangifera indica*.

The single regular tree has shown the following succession of leaf-periods.

Months				Months			
22. 7.28	..	..	—	25. 2.34	..	..	15.0
1. 9.29	..	..	13.3	20. 3.35	..	..	12.8
22. 9.30	..	..	12.7	April 1936	..	..	13.
27. 9.31	..	..	12.2	7. 5.37	..	..	13.
27.11.32	..	..	14.0	8. 7.38	..	..	14.0
Mean period: 13.3 months.							
Extremes: 12.2 and 15 months.							
Standard deviation: .86 month or 6.5%.							

Partial or complete (full) changes of leaves of the two large irregular trees were observed as follows:

Tree M				Tree W	
1927	..	..	Nov. part	Aug.	full
1928	..	..	..	March	part
1928	..	..	Aug.	Aug.	part
1929	..	..	April	March	full
			Sept.		
1930	..	..	March	March	full
1931	..	..	May	July	full
			Aug.		
1932	..	..	March	unrecorded	
			Oct.		
1933	..	..	Feb.	Jan.	full
			Aug.		
1934	..	..	unrecorded	unrecorded	
1935	..	..	Feb.		
			Oct.		
1936	..	..	Aug.	Oct.	full
1937	..	..	March	unrecorded	
				March	full

### **Homalium grandiflorum Benth.**

A tree of this species, which is native from Tenasserim southwards, has been under observation from 1932 to 1939, all leaf-changes except one having been observed. It will be seen that all periods were more than a year, the shortest being 12.5 months; one period of 17.5 months was however much longer than the others. It is not obvious why this very long period should have occurred. 1934 was a wet year (115 inches), but April, May and June, when leaf-fall might have been expected, were the driest months. Leaf-renewal took place after only 12.6 months on 30 December, 1936, though October and November had been wet months.

This tree flowers very rarely, with the new leaves.

Only one flowering was observed in the period under review. The observed dates of leaf-renewal are as follows:—

<i>Months</i>				<i>Months</i>			
8.	2.32	..	..	—	3.12.36	.	12 6
5.	4.33	..	..	12.9	18. 2.39	2	13 3
20.	9.34	..	..	17.5	6. 3 40	..	12 6
14.11.35	..	..	12.8				
Mean period: 13.7 months.							
Standard deviation: 1.9 months, or 13.9%.							

### ***Hymenaea courbaril* L.**

A fine tree of this West Indian species has been under observation since 1927 and was reported upon in my earlier paper. It is never bare of leaves, but it has produced new leaves regularly every year in January or February, simultaneously with the fall of the old leaves. Flowering follows, at the end of the new growth, in May or early June, and the fruits ripen and fall towards the end of the year. Exact dates are difficult to record with this tree, as new growth often begins on one branch and gradually spreads; but the tree is undoubtedly very regular in behaviour. There are indications that early or late ending of the wet season influence the time of leaf-renewal. Thus in 1928 wet weather persisted until February and new leaf-growth was not observed until 19th February. In 1930 new growth was observed on 12th January, following a dry December. In 1931 January was wet throughout, and the first new leaves were seen on 22nd February.

It is evident however that all trees of this species do not behave alike. In 1931 I reported on a tree that had flushes of new leaves on various branches in turn throughout the year, though occasionally renewing its leaves almost entirely at about the same time as the first tree. A third tree has since been noticed, which renewed its leaves in September 1935 and 1936. This tree renewed its leaves at the same time as the first, in February, 1940.

### ***Kigelia pinnata* DC.**

A tree of this African species, reported upon in 1931, has continued very regular in its behaviour, renewing its leaves rapidly in January or February each year, the mean date being 22nd January. As will be seen below, the standard deviation is very small; this is particularly significant, as the time of leaf-renewal is more sharply defined than in some other trees, and so the dates are more strictly comparable. Leaf-fall is complete within a fortnight, and

new growth usually begins just before the tree is bare. Flowering takes place on the old wood, sometimes just before leaf-fall, but more usually within two months afterwards. The flowers (which are open at night) are regularly visited by the local bats, but fruits are not set very freely.

A very interesting comparison of behaviour is provided by some young trees, raised from seeds obtained from Africa. These trees were planted out, as young seedlings, on 19th October, 1931. They dropped their leaves and made new growth, in November, 1932, November, 1933 and November, 1934. Then in March, 1935 they were dug and manured, and they made new growth in April, dropping the old leaves soon after. Leaf-fall and new growth subsequently took place in April, 1936 and April, 1937. This appears to indicate that the species tends to keep very accurately to a 12-month period, but that stimulus to root activity may induce premature new growth. Schweizer found that manuring of *Hevea* trees affected their subsequent leaf-fall and leaf renewal (see *Hevea brasiliensis*).

Though the first *Kigelia* tree has been very regular in its time of leaf-renewal, it has varied a little with the time of onset of drier weather after the wet season. Thus it was very early in January, 1935 after the unusually dry December, 1934.

Months				Months			
10. 2.29	..	..	—	14. 1.34	..	..	12.0
17. 2.30	..	..	12.2	5. 1.35	..	..	11.7
10. 2.31	..	..	11.8	13. 2.36	..	..	13.3
27. 1.32	..	..	11.5	5. 2.37	..	..	11.7
14. 1.33	..	..	11.4	15. 1.39	..	2 X	11.7
Mean period: 11.9 months.							
Extremes: 11.4 and 13.3 months.							
Standard deviation: .57 month or 4.8%.							
Mean date: 28 January.							

### ***Koompassia malaccensis* Benth.**

An old tree of this species, remaining from former primitive forest, was reported in 1931 to have renewed its leaves in three successive years in the month of September. This regularity subsequently changed, leaf-renewal being deferred until 8 November in 1930. In that year August was exceptionally dry, but there was a good deal of rain from September onwards, and possibly this wet weather was the cause of deferred leaf-fall. The next year leaf-renewal took place in December; then in 1933 there was no leaf-change at all, the next being in March, 1934.

After that there are two gaps in observations, dates noted being 17 May, 1936, 8 July, 1938, 15 June, 1939 and 12 May, 1940.

The mean period for 12 periods has been 12.7 months and the standard deviation not abnormally large; but I think that the incidence of dry weather or rain has considerable influence. Thus, once leaf-fall became deferred from September into the wet season, it became later and later, extending to March in 1934 when January and February were both very wet. In 1936 February was dry, but March very wet. New leaf-change is likely to continue about June and July, when fairly dry weather is frequent, for some years. If it does so, the mean period of 12.7 months will be seen to be too high. The rather early change in 1940 was probably due to unusual dry weather early in the year.

There is another tree of this species, beside a road outside the Gardens, doubtless also a relic of the former forest, which appears to have shorter and less regular periods, but I have not adequate observations on this tree.

The dates of leaf renewal, and the intervening periods in months, are as follows:—

<i>Months</i>				<i>Months</i>			
17. 9.27	..	..	—	18. 3.34	..	..	14.8
11. 9.28	..	..	11.8	17. 5.36	..	2 ×	13.0
8. 9.29	..	..	11.9	8. 7.38	..	2 ×	12.9
21. 8.30	..	..	11.5	15. 6.39	..	..	11.2
8.11.31	..	..	14.5	12. 5.40	..	..	10.9
25.12.32	..	..	13.4				

12 periods.

Mean period: 12.7 months.

Extremes: 10.9 and 14.8 months.

Standard deviation: 1.36 months or 10.7%.

### *Lagerstroemia flos-reginæ* Retz.

The same two trees mentioned in my earlier paper were kept under observation until 1937. The older tree continued to renew its leaves first on the lower branches. The early stages of growth of new shoots are very gradual and it is not easy to fix exactly comparable dates, even for the same branch. Part of the variation shown therefore may be due to this cause; but still it is not larger than in a number of others.

The smaller tree continued as before to change the north side at a different time from the south, though the matter was later somewhat complicated by the development of a small central part which was more or less intermediate. The origin of this behaviour can probably be traced to the fact that when the tree was first planted a larger tree stood near it on the north side, shading that side considerably. The north side of the tree, as shown in the table below,

had a somewhat longer average period and a somewhat greater standard deviation. The two sides were near together in 1927 (only a month apart) but the north side gradually lagged behind, at the end of 10 years being six months later than the south side.

A number of young trees of this species were planted out by one of the roads in Singapore about 10 years ago. At first most of these trees flowered about the same time, but later flowerings have shown increasing differences from tree to tree. It seems probable that each tree, according to its nature and surroundings, develops a fairly constant period of its own, and that there are small significant differences of period from tree to tree.

A tree in Penang renewed its leaves in 3 successive years in January or February. It is likely therefore that this species is sufficiently influenced by the regularity of climate at Penang to change its leaves at the dry season every year. Further observations on this point are now in progress.

The behaviour of the two Singapore trees is indicated by the following data:

<i>Smaller tree north side</i>			<i>Smaller tree south side</i>			<i>Old tree</i>		
<i>Months</i>			<i>Months</i>			<i>Months</i>		
20. 8.27	..	—	20. 7.27	..	—	3. 9.27	..	—
10. 6.28	..	9.7	12. 5.28	..	9.8	27. 5.28	..	8.8
21. 4.29	..	10.4	10. 3.29	..	10.0	10. 3.29	..	9.5
23. 2.30	..	10.1	17.11.29	..	8.2	17.11.29	..	8.2
25.11.30	..	9	1. 9.30	..	9.4	29.10.30	..	11.4
6. 9.31	..	9.4	3. 5.31	..	8.1	15. 6.31	..	7.6
5. 6.32	..	9.0	12. 2.32	..	9.3	27. 3.32	..	9.4
12. 3.33	..	9.2	20.11.32	..	9.3	18.12.32	..	8.7
1. 1.34	..	8.6	30. 7.33	..	8.3	24.10.33	..	10.2
15. 4.35	2 ×	7.8	30.12.34	2 ×	8.5	15. 6.35	2 ×	9.8
20. 8.37	3 ×	9.4	8.10.35	..	9.3	24. 2.36	..	8.3
Mean period:	9.2		9. 7.36	..	9.0	Dec. 1936	..	9.5
months.			24. 2.37	..	7.5	Oct. 1937	..	10.
Standard deviation:			Mean period:	8.9		Mean period:	9.4	
.88 months or 9.6%.			months.			months.		
			Standard deviation:			Extremes:	7.6 and	
			.77 months or 8.7%.			11.4 months.		
						Standard deviation:		
						.99 months or 10.5%.		

### **Lecythis sp.**

The tree of this species (probably *L. ollaria* L.) briefly reported upon in my previous paper has now completed 11 periods in almost exactly 11 years, with a standard deviation of only .71 month; it is thus one of the most regular trees

under observation. The fluctuations from year to year are not large, the longest period being 13.3 months and the shortest 11 months. I can see no correlation between rainfall records and these late or early leaf-changes.

The leaves of this tree turn rather bright yellow quite suddenly, and are all fallen in 2-3 weeks. New buds begin to open as soon as the tree is bare, or sometimes before all the old leaves have gone. The dates given are therefore closely comparable. This tree has never flowered, though it is fully mature.

A small tree, probably of the same species, planted near the former tree on 24th February, 1928, renewed its leaves about February 1931, 1932 and January, 1933. Subsequently it was dug and manured (no exact records kept) on more than one occasion and subsequent changes were irregular. It will now again be brought under observation.

The dates of leaf change of the older tree are as follows:—

<i>Months</i>				<i>Months</i>			
8.7.28	..	..	—	16.9.34	..	..	12.3
18.8.29	..	..	13.3	21.8.35	..	..	11.2
8.8.30	.	..	11.7	28.8.36	..	..	12.2
30.8.31	..	..	12.7	29.7.37	..	..	11.0
16.9.32	..	..	12.5	20.7.38	..	..	11.7
7.9.33	..	..	11.7	30.6.39	..	..	11.3

Mean period: 12.0 months.

Mean date: 11 August.

Standard deviation: 71 month or 5.9%.

### ***Mangifera foetida* Lour.**

A tree of this species grows beside my house and has been under observation since 1927 except during absences in 1930, 1934 and 1938. It is not deciduous but has presented a rather regular behaviour as regards leaf-renewal and is worth recording. When new growth occurs, each twig produces either new leaves or flowers, or both. In one case only new leaves were produced and then a general flowering occurred three months later; in another case a general growth of new leaves followed a month after a general flowering. The usual procedure however is for leaves and flowers to be produced simultaneously, and the records below are for such (except that of 20th April, 1935 when no flowers were produced). It will be seen that the tree is less regular than some of the deciduous

trees, but has a standard deviation of only 11.6%, thus indicating the probability of a leaf-renewal not altogether dependent on climatic factors. The old leaves do not fall immediately the new begin to develop, as in *Mangifera indica*; an inspection of the tree shows that on some twigs leaves persist for at least 2½ years, while on others less than 18 months. The actual dates of general leaf-renewal are as follows:

Months				Months			
23.	9.27	..	.. —	26.	2.33	..	.. 9.7
24.	6.28	..	.. 9.0		5.11.33	..	.. 8.3
3.	2.29	..	.. 7.4	20.	4.35	..	.. 17.5
18.	8.29	..	.. 6.5	27.	12.35	..	.. 8.2
23.	3.30	..	.. 7.2	1.	8.36	..	.. 7.1
6.	9.31	..	.. 17.5	1.	4.37	..	.. 8.0
5.	5.32	..	.. 8.0	23.	9.38	..	.. 17.7

Assuming 16 periods: mean period is 8.25 months.

Standard deviation: .96 month or 11.6%.

### ***Mangifera indica* L.**

The two trees by the lake in the Botanic Gardens, mentioned in my previous paper, were kept under observation until 1937. After 1930 the trees rarely changed their leaves completely, but usually changed on a group of branches at a time. Change, whether partial or complete, usually took place simultaneously on the two trees, but sometimes one tree had a partial change, while the other did not. Leaf-fall always accompanies leaf-renewal, and never precedes it, so that the trees are never bare.

Flowering is rare, having occurred three times only in 10 years. There may have been a few flowers at other times, but no general flowering. As in other countries, flowering appears to be quite independent of leaf change. Flowering follows dry weather, but not all dry periods produce flowering.

It appears that the leaves usually last 9 to 12 months, but may exceptionally last only 4 to 5 months on part of a tree. The case is evidently a complex one, and needs more careful observation. Though the behaviour of these trees may seem to be rather like that of Hevea, in the *Mangifera* leaf-renewal precedes leaf-fall, whereas the fall comes first in Hevea. This may mean a quite different mechanism of response to climatic change, but careful analysis of the behaviour of the trees is needed before we can be sure of this. *Mangifera* trees would be interesting subjects for experiment on the lines indicated by Schweizer.

The following table summarizes the behaviour of the two trees from 1928 to 1937. "Full" means a complete leaf-change, "part" means leaf-renewal on part of the tree only.

	<i>North tree</i>	<i>South tree</i>	<i>Flowering</i>
1928 .	July, full	July, full	
1929 ..	June, full	June, full	3.2.29
1930 ..	March, full	May, full	
1931 ..	end May, part	end March, full	
	July, part	July, part	
1932 ..	April, part	April, part	
	Aug., part	Aug., part	
1933 ..	Feb., part	Feb., part	26.2.33
	Aug., nearly full	June, part	
		Aug., part	
1934 ..	no record	Nov., full	25.2.34
1935 ..	March, full	Aug., part	
	end Oct. part	Nov., part	
1936 .	end March, almost full	end March, almost full	
		June, rest of tree	
		Sept., part	
1937 .	Feb., part	April, part	
	April, part		

#### **Parishia Maingayi Hook. fil.**

A tree of this species has been observed at leaf-change on five occasions, but not all consecutively. It appears probable however that the period is well over a year, in the neighbourhood of 15 or 16 months. I do not think it possible that the period is so short as half this, as the tree is in a fairly conspicuous place beside the potting shed at the Gardens, and though it was not on my regular list of trees, I could hardly fail to have observed it if it changed more frequently. It loses its leaves completely and stands bare for two weeks or more before leaf-renewal.

Herbarium specimens taken from the same tree prior to my observation of leaf-change indicate that the tree was flowering on the following dates: 25th April, 1923, 17th June, 1926 and 29th April, 1930. These specimens were probably taken about a month after the opening of the new leaf-buds. With this assumption, the dates in 1926 and 1930 agree with a leaf-period of about 15 months, but that of 1923 does not. The observed dates of leaf-renewal, and the estimated leaf-periods, are as follows:—

	<i>Months</i>		<i>Months</i>
20.10.32 .. ..	—	19. 5.39 ..	2 × 15.2
21. 7.35 .. 2 ×	16.5	10. 8.40 ..	.. 14.7
10.11.36 .. ..	15.6		

Probable mean period: 15.6 months.

Standard deviation: .96 month or 6.2%.

**Parkia javanica (Lam.) Merr.**

The tree of this species mentioned (as *P. Roxburghii*) in my earlier paper has behaved in a more regular manner than any other of which records have been kept. Its inflorescences appear in September or October, after which leaf-fall begins slowly, being completed about the beginning of February, the fruits ripening at the same time. New leaf-growth begins after the tree has been bare for about a fortnight. The mean date of leaf-renewal is 23rd February, and the standard deviation only .24 month or 7 days.

A very fine old tree of the same species in another part of Singapore has been observed in 1931, 1932, 1935, 1936 and 1937 to renew its leaves in March, about a month later than the tree in the Gardens. The data for the Gardens tree are as follows:

Months				Months			
27.	2.28	..	..	—	4.	3.34	.. .. 12.3
27.	2.29	..	..	12.0	20.	2.35	.. .. 11.6
17.	2.30	..	..	11.7	23.	2.36	.. .. 12.1
19.	2.31	..	..	12.1	15.	2.37	.. .. 11.7
21.	2.32	..	..	12.1	1.	3.39	.. 2 × 12.2
23.	2.33	..	..	12.1			
Mean period: 12.0 months.							
Mean date: 23 February.							
Standard deviation: .24 month or 2.0%.							

**Peltophorum pterocarpum (DC.) Backer.**

Two old trees of this species, mentioned in my earlier paper (as *P. ferrugineum*), have been regularly observed for 10 years, and have been very regular in their behaviour, the leaf-period averaging exactly six months, with standard deviation of less than half a month. The mean dates of 12th February and 10th August compare with 8th February and 11th August for *Terminulia catappa* over the same period.

The tree E mentioned in my earlier paper was evidently not in a vigorous state. Its leaf-changes were at rather long intervals (up to 9.5 months) and not at all regular. Observation of this tree was not continued.

The young tree F behaved much more regularly after the two short periods of 4.4 and 4.7 months in 1929–30. If the observations from 15th January, 1930 onwards are taken, the standard deviation is only .75 month or 11.0%, which is not excessive; I think the short periods were due to attack by caterpillars. Possibly the tree will approximate to 6 months as it grows older. Compare the behaviour of the young tree of *Couroupita*.

As noted in 1931, this species flowers at the end of the vegetative growth, the fruits ripening about the time of

leaf-fall or somewhat earlier. Flowering is sometimes absent, but this does not appear to affect the length of the leaf-period appreciably.

The behaviour of this species in Ceylon and Java is evidently irregular (*see* my 1931 paper, p. 201, references to Wright and Coster). When I was in Bombay in October 1937, I noticed that all the trees bore fruits, the result of flowering earlier in the year, and that most bore also some flowers, though not a full flowering; but there was no sign of new leaves. The Superintendent of the Victoria Gardens at Bombay kindly informs me that the trees lose their leaves gradually from December to February and produce new leaves in March. They thus renew their leaves once a year, in contrast to *Couroupita guianensis*, which changes twice a year both in Singapore and Bombay. I noted that the *Peltophorum* trees of Bombay were much taller than those I have seen in Malaya, though I could otherwise see no difference. It is possible that the Malayan trees belong to a distinct race with the peculiarity of a tendency to a short leaf-period.

Two old trees				T			
Months				Months			
8. 1.28	..	..	—	1. 4.28	.		
24. 6.28	..	..	5.5	11.11.28	..	..	7.3
3. 2.29	..	..	7.3	14. 4.29	..	..	4.1
21. 7.29	..	..	5.5	25. 8.29	..	..	4.4
30. 1.30	..	..	6.2	15. 1.30	..	..	4.7
8. 8.30	..	..	6.2	22. 7.30	..	..	6.2
4. 2.31	..	..	5.9	10. 3.31	..	..	7.5
23. 8.31	..	..	6.4	Nov. 1931	..	..	8.
28. 2.32	..	..	6.2	26. 6.32	..	..	7.5
11. 9.32	..	..	6.4	Feb. 1933	..	..	7.4
4. 3.33	..	..	5.8	17. 9.33	..	..	7.
26. 8.33	..	..	5.7	7. 1.35	..	2 ×	7.8
25. 2.34	..	..	6.0	20. 7.35	..	..	6.5
25. 8.34	..	..	6.0	1. 3.36	..	..	7.4
27. 2.35	..	..	6.1	2.10.36	..	..	7.0
22. 8.35	..	..	5.8	20. 4.37	..	..	6.6
21. 2.36	..	..	6.0	Mean period: 6.8 months.			
28. 8.36	..	..	6.2	Standard deviation: 1.27 months			
6. 2.37	..	..	5.3	or 18.7%.			
10. 8.37	..	..	6.1	Mean period from 15.1.30 on-			
13. 7.38	..	2 ×	5.6	wards: 7.3 months.			
20. 2.39	..	..	7.2	Standard deviation: .75 month			
Mean period: 6.0 months.				or 11.0%.			
Standard deviation: .43 month							
or 7.2%.							
Mean dates: 12 Feb. and 10							
Aug.							

### ***Pterocarpus indicus* Willd.**

There is a note about this species in my former paper (p. 202). I have little further to add concerning the periodicity of leaf-change of trees in Singapore. They are

certainly less regular and less free-flowering than in the seasonal climate of Penang; and trees in Singapore tend to change their leaves a branch or more at a time, often taking weeks or months to renew their leaves on all branches. Flowering follows new leaf-growth, and the extent of flower-bud production is probably influenced by climatic factors. Trees of this species in any one locality show a remarkable gregarious flowering which has been little noted in botanical literature.

The inflorescences develop up to a stage when the flower buds are well grown, and then rest for a time; then all buds which have reached this stage will suddenly flower, often making a most spectacular display, lasting only a day. The next lot of buds will go through the same process, each inflorescence flowering usually in two or three stages. It is a remarkable sight in Penang to see many trees clothed almost all over with gold; the flowers are small, and in a full display do not show individually.

The stimulus causing all buds at the receptive stage to develop is undoubtedly a fall of temperature, as in other cases of gregarious flowering (notably of the common orchid *Dendrobium crumenatum*). It appears that three days only are needed from the stimulus to the opening of the flowers. The stimulus may be a sudden fall of about 10° F., such as often accompanies a storm during the heat of the day; or a cool day, in which the temperature does not rise appreciably above 80° F.

All cases of flowering recorded by me in Singapore in the year 1940 (21 occasions) have followed three days after one or other of these temperature conditions. The sudden fall of temperature has ranged from 7° to 15° F. The largest flowering of all followed three days after a day of very uniform cool temperature.

As an indication of the slow rate of leaf-change, and the dispersal of flowering of one tree over considerable periods, the following case is of interest. A tree near my house bore flowers on 21 separate occasions between 9th April and 20th July, 1940. Most of these were only small flowerings, only two involving any large part of the crown of the tree. In the previous year (1939) the same tree flowered on 8 occasions in August and September. The biggest general flowering of trees in Singapore in 1939 was in June, and in 1940 on 30th May.

### *Salmalia malabarica* (DC.) Schott & Endl.

The two trees reported on in 1931 (under the name *Bombax malabaricum*) have been kept under observation, and have continued to behave in a similar manner, the upper tree with a consistently longer period than the lower, as

shown below. The standard deviation of the tree with longer period (which is also the more vigorous of the two) is only .44 month; of the other tree .98 month. The trees always have a bare stage of 2-3 months irrespective of the time of year. Leaf-renewal has occurred in almost every month of the year.

It should be noted that these two trees are not growing under very favourable soil conditions and that their growth is poor. They will form interesting material for cultivation and manurial experiments (*see* remarks under *Kigelia*), which have now begun.

<i>Upper Tree</i>				<i>Lower Tree</i>			
		<i>Months</i>				<i>Months</i>	
30. 3.28	..	..	—	30. 3.28	..	..	—
17. 2.29	..	..	10.6	16.12.28	..	..	8.5
18.12.29	..	..	10.0	6.10.29	..	..	9.7
1.11.30	..	..	10.4	10. 6.30	..	..	8.1
4.10.31	..	..	11.1	3. 5.31	..	..	10.8
1. 8.32	..	..	9.9	6. 3.32	..	..	10.1
4. 6.33	..	..	10.1	1.12.32	..	..	8.9
1. 5.34	..	..	10.9	6. 8.33	..	..	8.2
7. 4.35	..	..	11.2	20. 4.34	..	..	8.5
16. 2.36	..	..	10.3	18. 3.35	..	..	10.9
21. 8.39	..	4 ×	10.5	6.10.36	..	2 ×	9.3
Mean period: 10.5 months.				15. 7.37		..	9.3
Extremes: 9.9 and 11.2 months.				Mean period: 9.3 months.			
Standard deviation: (excluding				Extremes: 8.2 and 10.9 months.			
1936-39) .44 month or 4.2%.				Standard deviation: .98 month			
				or 10.5%.			

### *Saraca taipingensis* Cantley.

A fine tree of this handsome Malayan species has been under observation for some years. The tree is evergreen, flowering on the old wood, independently of the production of new leaves. New leaves are produced in flushes at irregular intervals, but the old leaves do not immediately fall.

Though I cannot trace a definite connection between flowering and dry weather, it is fairly clear that flowering follows about a month or so after the beginning of a period of dry weather. The extent of the flowering naturally depends on how recently the tree flowered last. There are usually two fairly full flowerings in a year, and often small flowerings between. The flowerings recorded between 1927 and 1937 have been in the following months:—

January	..	Once	July	..	Once
February	..	Three times	August	..	Six times
March	..	Six times	September	..	Four times
April	..	Once	October	..	Twice
June	..	Once			

This indicates that the flowering tends to be in February-March and August-September, following the principal dry periods.

New leaves come in flushes at irregular intervals. As the old leaves do not fall when the new develop, the new growth is not dependent on the age of the old leaves. It seems to be most frequent soon after wet weather which follows a dry period, but this is not invariably the case, and the response is probably a rather complex one, dependent on the condition of the tree as well as on the weather.

### ***Sindora Wallichii* Benth.**

The two trees of this species mentioned in 1931 have continued to behave irregularly as regards leaf-change, but records are incomplete. The tendency seems to be for a minimum leaf-period of about 12 months, with possible retention of leaves up to about 18 months. There is some indication that continued wet weather about 12 months from the last leaf-change prolongs the life of the old leaves; but the two trees do not always behave alike in this matter. Thus, they both renewed their leaves completely in February 1931; one tree renewed them again in February, 1932, though January, 1932 was not a very dry month, but the other delayed until August 1932 before renewal. The first tree had previously renewed its leaves in September, 1929, but failed to do so in September, 1930, though July and August were both unusually dry, deferring renewal until February, 1931.

The trees are slowly deciduous over a rather long period, and sometimes leaf-renewal occurs on part of the tree only, on other parts later. The response is evidently a complicated one.

### ***Sterculia carthaginensis* Cav.**

The tree of this species mentioned in 1931 has been under observation since that time and has proved to be a very interesting case, comparable with that of *Hevea*, but less sensitive to climatic change. Its behaviour is worth considering in some detail.

The first leaf-renewal observed was on 11th December, 1927. The period from 12th November to 10th December was exceptionally dry, rainfall amounting to only 2.60 inches, instead of an average of about 10 inches. The next leaf-renewal was observed on 22 July, 1928, following a dry June. The next renewal occurred on 10th March, 1929; the rainfall in February was 10.97 inches, but there was a rather dry period from the 4th to 15th inclusive (12 days) with 1.00 inch, which may have caused leaf-fall to begin.

The weather was wet from August to November, 1929, December having only 4.49 inches. The tree had new leaves on a few branches about 10th December, but did not renew

all leaves until 17th February, 1930; the weather was dry from 12th January onwards (1-11th January, 3.17 inches; 12-31st January, 0.72 inch). It is strange that the two unusually dry months of July (1.89 inches) and August (1.13 inches) did not cause another general leaf-change, but there were small developments of new leaves at various times between August and November, 1930, (16th to 29th September and October 7th to 16th, were also dry periods). The next general leaf-renewal took place on 21st February, 1931; January was very wet up to the 19th, but from the 20th to 16th February the rainfall was only 1.80 inches. There was no more dry weather during the rest of the year (not more than six consecutive days without rain at any time) but a few new leaves were produced by the tree in December.

In 1932 the early part of January was dry (1-17th, .56 inch), but leaf-renewal was deferred until 20th February. Following dry weather in July and August, there was occasional small leaf-renewal on various branches between July and October, but no general renewal until 16th January, 1933. There was hardly any wet season in the latter part of 1932, and only 1.19 inches rain from 3rd to 19th December; this presumably induced an early leaf-renewal in 1933.

In 1934 and 1935 there was again leaf-renewal in January, that of 1935 being early (12th) following a very dry December. There was an unusually large partial leaf-renewal on 18th September, 1935, about half the tree being involved; this followed a very dry July and August (2.73 and 3.03 inches). November and December, 1935, were wet, and also January, 1936; dry weather began on February 1st and a general leaf-renewal (involving the fall of those leaves produced in September, 1935) began on 3rd March, 1936.

The wet season at the end of 1936 was normal with a short break at the beginning of January, 1937, the rest of January being wet. Leaf-renewal occurred on 13th February. No further change occurred up to October, 1937. I have no record of the behaviour of the tree at the beginning of 1938. There was a dry fortnight in January and leaf-renewal probably took place in February. July was very dry with 2.4 inches and there was another dry period in October (2.7 inches in 24 days). It was presumably this which caused a complete leaf-renewal on 30 November. Though there was a good deal of dry weather in February and March, 1939, leaf-renewal did not occur until 8th May, a period of 5.3 months.

This tree is clearly unstable. It appears to have a minimum period of five months (5.5 months from the

half-renewal of 18th September, 1935 to 2nd March, 1936, and 5.3 months from 30th November, 1938 to 8th May, 1939) and a maximum of about 12 months (prolonged for some leaves to 13.7 months, on one occasion, following the large partial change of September, 1935). It appears that after about 5 months any pronounced dry weather may cause at least a partial leaf-fall, followed by leaf-renewal on the branches affected; leaf-renewal occurs a month or more after the onset of the dry weather (in a complete change, leaf-fall is complete in 2-1 weeks after the first signs of brown leaves). But it should be noted that where new leaves are produced on only a few small branches, these fall at the next general leaf-fall, even though this occurs only 2 or 3 months later.

The following table shows dates of complete changes only, with the intervening periods in months. For the years 1929-1937, the mean period was 12.1 months, with standard deviation 88 month or 7.3%.

Months			Months		
11.12.27	..	—	21. 1.34	..	12.2
22. 7.28	..	7.4	12. 1.35	..	11.7
10. 3.39	..	7.6	2. 3.36	..	13.7
17. 2.30	..	11.2	13. 2.37	..	11.4
21. 2.31	..	12.1	30.11.38	2	10.8
20. 2.32	..	12.0	8. 5.39	..	5.3
16. 1.33	..	10.9	22. 2.40	..	9.5

### *Sterculia macrophylla* Vent.

I have short series of records of three trees of this species, one in Penang and two in Singapore. Two of the trees have shown a fairly regular period of 6.4 to 8.2 months; the third tree was in poor condition, and much more irregular, in 1927-31. This third tree was subsequently cultivated and became more vigorous. It showed a period of 9.2 months in 1938-39. The records indicate this species as a short-period tree, both at Penang and Singapore. Its natural distribution is said to be confined to Malaysia. Records of its behaviour in the more strongly seasonal climate of East Java would be interesting. The following are data available for the three trees above mentioned.

Penang		Singapore		Singapore	
	Months		Months		Months
8. 1.31	.. —	28. 2.35	.. —	7. 9.27	.. —
14. 9.31	.. 8.2	8. 9.35	.. 6.4	5. 8.28	.. 10.9
June 1932	.. 6.	30. 3.36	.. 6.8	1. 6.29	.. 9.9
3. 1.33	.. 6.5	20.11.36	.. 7.7	20. 6.30	.. 12.6
Aug. 1933	.. 7	27. 6.37	.. 7.2	2. 2.31	.. 7.4
				8.10.38	.. —
				15. 7.39	.. 9.2
				13. 3.40	.. 8.0

**Sterculia sp.**

This tree, the species of which has not been identified, has been under observation for 12 years and has had a mean leaf-period of 10.1 months, with a good deal of variation. The standard deviation however is little more than 10% of the mean period. The data are as follows.

Months				Months			
16.	9.27	..	.. —	Dec. 1933	..	2	× 9.5
12.	8.28	..	.. 10.9	25.	8.35	..	2 × 10.
1.	6.29	..	.. 9.7	28.	5.36	..	.. 9.1
14.	4.30	..	.. 10.4	March 1937	..	..	.. 9.5
5.	4.31	..	.. 11.7	22.	8.39	..	3 × 9.7
10.	3.32	..	.. 11.2	21.	4.40	..	.. 8.0
13.	3.33	..	.. 12.1				
15 periods.							
Mean period: 10.1 months.							
Standard deviation: 1.26 month or 12.5%.							

**Tamarindus indica L.**

The old tree mentioned in my paper of 1931 died not long afterwards. The young tree was kept under observation, but being planted in a clay soil was not in a very vigorous condition. It showed a tendency to have periods of less than a year for three years, but then had a period of 17.7 months, the subsequent leaf-growth being poor and slow in developing. In September, 1938, three months after a leaf-renewal, the tree was well dug and manured, new leaf-growth occurring two months later. The future development will be watched with interest. The dates of new leaf-growth are as follows.

Months				Months			
15.	2.31	..	.. —	15.12.34	..	..	10.
28.	2.32	..	.. 12.4	4.12.35	..	..	11.7
24.	3.33	..	.. 12.8	25.	5.37	..	.. 17.7
15.	2.34	..	.. 10.7	1.	6.38	..	.. 12.2
Manured 18.9.38.							
November 1938, more new leaves.							

**Terminalia catappa L.**

Records have been continued of the behaviour of the tree mentioned in 1931. It has subsequently shown more irregularity than was indicated in the period 1927–31. This irregularity was chiefly in 1932–34, and is probably to be traced to the dry weather of August to December, 1932, which caused a leaf-renewal on 25th December, 1932, after a period of only 4.5 months. This was followed by three rather long periods, which brought the month of leaf-change to August once more. The long period of 1936 is surprising,

as the months of June, July and August were all fairly dry. New growth of leaf-buds is rapid and simultaneous all over the tree, so that dates are closely comparable.

As noted previously, this species changes its leaves twice a year in the strongly seasonal climate of east Java, in Ceylon, and in West Africa. In East Java it changes its leaves in the latter part of the wet season, and again in the latter part of the dry season. On the analogy of the behaviour of the Singapore tree, one would expect the leaf-periods in East Java ending February–March, during which the weather is much wetter than in the other period, to be longer, and the drier leaf-period, ending August–September, to be shorter. Records on this point would be interesting. It is clear that the species tends to have a leaf-period of about six months, and that the present tree is more sensitive to external influence than the tree of Couroupita, but less so than the trees of *Ficus variegata* mentioned in this paper.

At Peradeniya there are two dry seasons (one longer than the other) and the change occurs during the dry seasons. In Singapore the mean dates of leaf-change of the tree observed (8th February and 11th August) also correspond with the periods when dry weather is most frequently experienced.

Recorded dates of leaf-renewal of the Singapore tree are as follows.

<i>Months</i>				<i>Months</i>			
8. 1.28	..	..	—	11. 6.33	..	..	6 6
8. 7.28	..	..	6.0	21. 1.34	..	..	7.3
3. 2.29	..	..	6.8	20. 8.34	..	..	7 0
11. 8.29	..	..	6.3	28. 2.35	..	..	6.2
9. 2.30	..	..	6.0	10. 8.35	..	..	5.5
8. 8.30	..	..	6.0	18. 2.36	..	..	6 3
6. 2.31	..	..	6.0	20. 9.36	..	..	7 1
20. 8.31	..	..	6.5	12. 3.37	..	..	5 6
6. 2.32	..	..	5.5	9. 9.37	..	..	5 9
9. 8.32	..	..	6.1	1. 9.38	..	2 ×	5 9
25.12.32	..	..	4.5	15. 3.38	..	..	6 5

Mean period: 6.1 months.

Extremes: 7.3 and 4.5 months.

Standard deviation: 64 month or 10.5%.

Mean dates: 8th Feb. and 11th Aug.

### ***Terminalia subspathulata* King.**

This local species is represented by a fine tree on the edge of the Gardens Jungle in Singapore. This tree has been very regular in its behaviour since 1928. It begins to lose its leaves about October and loses them slowly all through the wetter season, more rapidly when the drier weather begins in January or February, and is nearly bare

for perhaps a month before the new buds begin to open. The opening of the buds is quite rapid and simultaneous all over the tree, so that dates are closely comparable. Flowering does not occur every year.

The factors which influence the date of leaf-renewal are probably rather complex, as the period of leaf-fall extends over several months. There is little doubt that the tree has a natural tendency to a 12-month leaf-period, and also that the occurrence of the bare period immediately following the break at the end of the wet season is significant; but the slow loss of leaves through the wet season is curious. The data for this tree are as follows.

<i>Months</i>				<i>Months</i>			
19.4.28	..	..	—	10.5.34	..	..	13.3
17.3.29	..	..	10.9	27.3.35	..	..	10.6
16.3.30	..	..	12.0	10.4.36	..	..	12.5
31.3.31	.	.	12.5	29.4.37	..	..	12.6
10.4.32	..	..	12.3	12.4.39	..	2	11.7
2.4.33	.	..	11.7	12.3.40	..	..	11.0

Mean period: 11.9 months.

Standard deviation: .83 month or 7.0%.

Mean date: 6th April.

## RAINFALL, IN INCHES, AT THE BOTANIC GARDENS, SINGAPORE

1927

	January	February	March	April	May	June	July	August	Sept.	October	Nov.	Dec.
1	3.94	2.07	—	.70	.01	—	—	—	—	2.45	—	.09
2	.91	.40	—	.01	.70	—	—	—	.02	.40	1.15	.24
3	.24	1.22	—	.01	.60	.01	1.31	.13	.08	.20	.20	.06
4	.06	.05	.99	.03	.66	.25	.06	—	—	.91	—	.06
5	—	.07	3.76	.07	—	.16	.52	—	1.31	—	.50	.01
6	.01	.07	.29	—	—	—	.10	.11	—	.30	.31	.09
7	—	—	.27	—	.57	—	.01	.07	—	.17	.08	—
8	.02	—	.31	.06	.03	—	.13	—	—	.56	1.13	.01
9	.14	—	1.21	.13	1.39	.45	.04	—	—	.36	.71	—
10	.99	.01	.02	.30	—	1.39	.89	—	—	—	—	—
11	.03	.31	—	—	.62	—	.03	.27	.14	—	3.14	1.52
12	1.27	.12	—	—	—	.11	—	—	.03	—	—	.59
13	—	.15	—	1.64	—	—	—	.01	.03	.01	.02	.21
14	1.01	.19	—	—	—	—	—	—	—	.11	.01	.07
15	2.35	.03	.11	—	.45	—	—	.02	—	—	.27	—
16	.06	1.29	—	—	.07	—	.29	—	—	—	—	.15
17	.18	—	—	.08	.28	.03	.41	—	.44	—	.13	—
18	—	—	.21	.14	.26	—	.07	—	—	—	.01	.01
19	1.41	—	2.89	1.89	—	.05	—	—	.09	—	.05	—
20	.21	.60	2.01	1.47	1.12	.12	.10	.92	—	—	.04	.03
21	.08	.82	.06	.13	.23	.34	—	.19	.03	—	.13	.02
22	—	.20	.03	1.27	.13	.01	—	1.46	.46	.16	—	.04
23	.06	—	1.87	.35	—	.13	—	1.31	.07	—	.07	.49
24	1.37	.01	.04	.84	—	—	.84	—	.54	—	.09	2.59
25	.01	—	.06	.89	.03	.37	—	.04	.06	.22	.13	.01
26	—	.01	—	.16	.02	.15	—	—	1.22	.34	.12	3.67
27	—	.95	—	—	.21	.94	—	.80	.36	.70	.01	.51
28	1.68	2.40	.09	.06	—	—	—	.04	.02	.01	—	.57
29	.62	—	—	1.72	.76	—	—	—	—	.03	.04	.22
30	.03	—	.41	.68	—	—	—	—	.78	.35	—	—
31	1.64	2.15	—	—	—	—	—	—	—	.49	—	.02
	18.32	10.97	16.80	11.83	9.14	4.38	3.98	5.37	5.65	7.97	9.28	11.35

Total for the year: 115.24 inches.

## RAINFALL, IN INCHES, AT THE BOTANIC GARDENS, SINGAPORE

1928

	January	February	March	April	May	June	July	August	Sept.	October	Nov.	Dec.
1	.01	—	—	1.70	—	—	—	.21	—	.84	1.11	—
2	2.04	1.07	—	—	—	—	—	—	—	.03	.67	.25
3	1.37	.16	—	—	—	—	.09	1.37	1.23	.10	1.36	—
4	.01	.06	—	—	—	.35	—	—	—	—	—	.07
5	.09	—	—	.92	.29	—	.52	—	—	.24	.03	.78
6	.75	—	—	.08	—	.08	—	.06	—	—	—	—
7	.20	2.02	—	.93	—	—	1.16	.01	.26	.38	—	.90
8	.03	—	—	1.68	.95	—	—	—	.40	—	.21	.63
9	1.00	—	—	.43	1.25	.16	—	—	.33	.36	2.00	1.31
10	.68	—	1.52	.98	—	.35	.89	—	—	—	1.65	.32
11	.48	.42	—	—	—	—	2.04	.05	—	.06	—	—
12	4.08	1.06	—	.06	.39	.08	.19	—	.06	—	.03	—
13	.02	—	—	.65	.02	—	—	.61	2.56	—	1.39	.41
14	.76	—	—	—	—	1.54	—	.09	.59	.03	.26	.17
15	—	.50	.09	1.14	—	—	—	—	.32	.15	.15	.26
16	—	.57	.02	.26	.15	—	—	.62	.18	.18	1.41	1.25
17	—	.26	.25	—	—	—	—	—	—	2.46	4.20	.71
18	—	.02	1.29	1.05	.20	—	—	—	—	.41	.26	—
19	—	.01	1.17	1.32	—	.31	—	1.11	—	.13	.18	—
20	.02	.55	—	—	—	—	—	.30	—	1.04	.59	—
21	.06	—	.50	—	—	—	—	—	.48	.15	—	.03
22	.50	—	1.10	—	—	.65	—	—	1.62	—	—	.22
23	.71	.41	—	.55	—	—	—	—	—	.31	—	—
24	.08	3.02	—	—	.13	—	—	1.75	1.14	—	.13	—
25	1.20	.16	.16	—	—	—	—	1.25	—	—	.19	.01
26	.15	—	.01	—	—	—	—	.72	—	.61	—	.17
27	.01	—	2.01	.07	—	—	.12	.15	.02	—	—	—
28	—	1.05	.12	—	.37	—	—	—	—	—	—	1.44
29	—	.15	.51	—	.08	—	—	1.42	—	—	.44	.23
30	—	—	—	—	.10	.18	—	—	.61	—	—	—
31	—	—	—	—	—	—	2.32	.39	—	—	—	.43
	14.29	11.49	8.75	11.87	3.63	3.70	7.33	10.74	9.80	8.08	17.68	10.28

Total for the year: 117.66 inches.

## RAINFALL, IN INCHES, AT THE BOTANIC GARDENS, SINGAPORE

1929

	January	February	March	April	May	June	July	August	Sept.	October	Nov.	Dec.
1	.96	.65	—	.06	—	.09	—	—	.10	—	.46	.14
2	.68	1.70	—	.77	—	—	—	—	—	—	—	.45
3	—	—	—	—	.16	—	—	—	—	—	—	.23
4	—	.14	—	.06	—	—	—	—	.07	.10	—	.04
5	2.48	.33	—	—	2.85	.73	—	—	.64	—	—	.27
6	.30	.29	—	—	.21	.03	—	—	.11	1.30	.49	.01
7	—	—	—	—	—	.09	—	—	.05	.15	—	.08
8	—	.08	—	—	.16	.30	—	—	—	—	.01	.11
9	—	—	—	—	—	—	—	—	—	.30	.12	—
10	—	—	1.95	—	—	.37	—	.20	.05	.19	2.30	—
11	—	1.67	.20	—	—	—	—	1.61	—	.67	.05	—
12	.15	.05	.13	.62	.56	.02	—	1.31	.70	.14	—	—
13	—	.25	.11	—	.27	—	.28	—	—	.08	.27	—
14	.10	—	.20	.01	.34	—	—	—	.11	—	2.56	—
15	—	.91	.21	.01	—	—	.31	.07	—	.03	.14	—
16	.16	—	—	—	—	.22	.64	—	.50	—	.01	.29
17	.16	.13	.01	.02	—	—	—	—	.21	—	—	.56
18	—	.14	.03	—	—	—	.08	—	—	.52	1.65	—
19	—	—	.68	.09	—	.73	.09	—	.05	.24	.33	.56
20	—	—	.18	.10	1.26	—	.12	—	—	—	.46	.23
21	—	.94	—	—	—	—	—	—	—	.19	—	.11
22	.23	—	—	—	—	—	—	—	.02	.06	.06	—
23	—	—	—	—	—	—	—	—	—	—	—	—
24	—	.67	—	.34	.07	.45	—	.37	—	—	—	—
25	—	—	—	—	—	1.72	.63	.34	.05	2.06	.51	.02
26	—	.57	1.96	.14	.92	.82	—	—	—	.10	—	—
27	—	.47	.57	—	.28	—	—	.09	.13	1.56	—	.92
28	—	—	.04	—	.22	2.52	—	.07	5.80	.25	1.96	—
29	—	—	—	.29	.13	.02	—	1.93	.15	.18	.08	.31
30	—	—	—	—	—	—	—	1.98	.33	—	—	.16
31	—	—	1.98	—	1.24	—	—	—	—	—	—	—
	5.22	8.09	9.06	2.51	8.67	8.11	2.13	7.97	9.04	8.31	11.61	4.49

Total for the year: 86.05 inches.

## RAINFALL, IN INCHES, AT THE BOTANIC GARDENS, SINGAPORE

1930

	January	February	March	April	May	June	July	August	Sept.	October	Nov.	Dec.
1	—	—	—	.16	.24	—	—	—	.02	—	1.34	1.44
2	—	—	—	—	1.42	—	—	—	—	.06	—	—
3	—	—	—	—	.51	—	—	—	—	—	.04	.09
4	1.12	—	.01	.52	2.27	—	—	—	—	.09	.20	.27
5	.35	—	—	2.48	—	—	—	—	.19	.08	.56	.83
6	—	—	—	2.62	—	.12	.28	.18	—	1.13	.48	—
7	.06	—	—	.13	.03	—	—	—	1.05	—	—	.03
8	—	—	.40	—	.91	—	—	—	—	—	.01	.88
9	—	1.84	—	—	.19	—	—	—	—	—	—	—
10	1.13	1.91	.86	.02	.07	—	—	—	—	—	—	.17
11	.42	—	.35	1.70	1.29	3.79	.01	.24	.05	—	.02	.55
12	—	—	.58	—	.25	—	.10	—	.02	—	—	—
13	—	—	—	—	—	—	—	.06	1.29	—	—	—
14	.04	—	.15	1.34	—	1.38	—	—	—	.25	.03	.43
15	.10	—	1.79	.09	—	—	—	—	.56	—	—	1.47
16	.30	.05	—	—	—	.11	—	—	—	—	.02	.31
17	—	.03	1.31	—	.67	5.48	—	.22	—	1.33	2.38	—
18	—	.16	.13	—	—	1.01	—	—	—	1.57	1.65	.80
19	—	—	—	.24	—	.22	—	—	—	.07	.08	.13
20	.07	—	—	.16	.67	.11	—	.01	—	—	.03	.50
21	—	—	—	.84	—	—	—	—	—	.25	.09	—
22	—	—	.13	.57	—	.31	.36	—	—	.40	.39	.53
23	—	—	—	.26	—	—	.30	—	—	.21	—	—
24	—	—	—	3.37	1.83	—	—	—	—	.72	—	—
25	—	—	—	—	.17	—	—	.31	.24	1.65	.18	.89
26	—	—	—	—	—	—	—	.11	.23	.20	—	.01
27	.21	.10	—	—	—	—	—	—	—	—	.56	.09
28	—	—	—	—	—	—	.63	—	—	—	2.33	.02
29	—	.29	—	—	—	—	.14	—	2.50	.13	.15	.16
30	—	—	—	—	—	—	.07	—	.13	.23	.29	.07
31	—	—	—	—	—	—	—	—	.64	.64	—	.41
	3.89	4.38	5.71	14.50	10.52	12.53	1.89	1.13	7.21	9.01	10.82	10.08

Total for the year: 91.67.

RAINFALL IN INCHES, AT THE BOTANIC GARDENS, SINGAPORE

1931

	January	February	March	April	May	June	July	August	Sept.	October	Nov.	Dec.
1	.41	—	—	.12	.04	.01	1.43	—	—	.07	.85	.68
2	.13	—	.04	.10	—	—	.03	—	—	1.28	.09	—
3	.47	1.01	.21	.85	.35	1.33	.63	—	.05	—	.02	—
4	.02	—	—	.01	.35	2.12	.07	—	—	.43	.16	.04
5	—	—	.49	1.90	—	.22	—	.67	—	—	1.73	.17
6	.06	—	.06	—	—	—	—	—	.02	—	—	2.61
7	.16	.29	.16	.34	—	—	.82	—	—	—	2.59	—
8	.08	—	—	—	.21	—	—	.24	—	—	—	.02
9	.03	—	—	.32	—	—	.41	—	.19	1.17	.78	.48
10	.14	—	.81	—	.40	—	—	—	—	.49	—	.01
11	.30	—	.40	.64	.09	.67	—	—	.23	—	.79	.12
12	1.67	—	1.04	—	1.43	—	—	1.61	.10	.30	.26	.15
13	1.20	—	—	—	.14	—	—	.03	.03	—	.11	.11
14	1.41	—	.34	.02	—	.06	—	.29	.88	—	—	.54
15	1.44	.12	—	.08	—	—	—	.14	—	—	—	.26
16	.51	.03	—	—	—	—	—	—	1.01	.05	—	.11
17	.19	2.23	—	—	1.48	.03	—	—	—	.06	1.16	.16
18	1.21	.02	—	1.31	—	—	—	—	—	—	.04	—
19	.76	—	.02	—	—	—	.05	—	1.69	—	1.08	.45
20	—	—	.24	—	—	—	—	—	.06	.64	—	—
21	.08	—	.01	.21	—	.29	1.37	—	1.54	—	—	—
22	.10	—	1.52	—	1.02	.42	—	.07	2.09	.71	—	.10
23	.57	—	—	.39	.09	.46	—	—	.06	.19	.06	.25
24	.36	1.02	—	.22	—	1.39	.47	—	1.09	—	.71	2.56
25	—	—	—	—	—	.51	—	—	—	—	.35	.79
26	—	—	—	.21	.99	—	2.39	1.89	—	.31	1.08	.80
27	.24	—	—	.29	.07	—	—	.21	—	—	—	.36
28	—	—	—	.24	.18	—	.17	.23	.12	1.32	.76	.13
29	—	—	.28	.31	2.14	—	.34	.82	—	—	.90	—
30	—	—	.65	—	—	—	—	—	.42	1.28	—	.07
31	—	—	1.27	—	.12	—	.41	.01	—	—	—	.07
	12.14	4.72	7.54	7.56	9.10	7.53	8.54	6.21	9.58	8.30	13.52	11.54

Total for the year 109.28 inches.

## RAINFALL, IN INCHES, AT THE BOTANIC GARDENS, SINGAPORE

1932

	January	February	March	April	May	June	July	August	Sept.	October	Nov.	Dec.
1	—	—	1.27	.04	.89	—	.66	—	.10	.22	.37	.02
2	—	—	—	.96	.01	—	1.63	—	—	—	.16	2.10
3	—	—	—	.40	—	—	.01	.22	.87	—	—	.08
4	—	—	—	—	.95	.48	—	—	—	—	.03	.31
5	—	.03	—	.40	—	—	.02	—	.35	—	.24	.05
6	.31	—	—	—	—	.88	1.23	—	—	—	—	—
7	.12	.29	—	.70	.22	—	2.10	—	—	—	.13	.07
8	—	—	—	.86	1.61	.39	2.88	.03	.31	—	.14	.51
9	—	—	—	.05	—	—	—	—	.17	—	1.76	—
10	—	.21	—	.75	—	.14	2.40	—	—	—	.71	—
11	—	—	—	—	—	—	.14	—	3.25	.60	.34	.01
12	—	—	.01	—	1.81	—	—	.09	—	.11	—	—
13	—	—	.04	1.06	—	—	—	—	—	—	—	.16
14	.13	—	—	.06	—	.02	—	.04	.22	—	.62	—
15	—	.83	—	.03	—	.06	—	.02	—	—	.04	—
16	—	—	—	.10	.03	—	—	.07	.62	—	—	—
17	—	—	—	.11	.54	.20	—	.29	—	.11	.32	—
18	.51	—	—	—	—	.03	—	.07	—	.07	.02	—
19	—	1.25	—	—	—	—	—	.07	—	—	.03	.95
20	.37	.60	.06	—	.05	.16	—	.10	—	.09	—	—
21	1.11	1.02	.72	.47	.24	—	.40	—	.05	—	—	.15
22	1.14	.12	1.94	—	—	.70	.55	—	.20	.33	—	.23
23	.23	—	.60	.38	2.67	—	—	—	1.85	—	—	—
24	.03	.31	.56	—	3.94	—	—	.12	—	.28	—	.09
25	.01	—	—	.04	.31	—	—	.19	—	—	.13	.29
26	1.14	.24	1.02	.13	—	1.89	—	—	—	1.04	—	.17
27	1.09	—	.12	—	.17	.08	.07	—	.09	—	—	1.20
28	.35	—	—	—	—	—	—	.41	.54	.36	—	.20
29	—	—	.33	—	—	—	—	.12	.02	—	.15	—
30	—	—	.03	—	1.28	—	1.90	—	—	.04	—	—
31	—	—	—	—	—	—	—	—	—	—	—	—
	6.67	4.90	6.70	6.04	14.62	5.03	13.99	1.83	8.54	3.29	5.19	6.39

Total for the year 83.39 inches.

## RAINFALL, IN INCHES, AT THE BOTANIC GARDENS, SINGAPORE

1933

	January	February	March	April	May	June	July	August	Sept.	October	Nov.	Dec.
1	—	—	.78	.57	—	—	—	—	.03	—	—	—
2	—	1.93	1.14	.82	—	—	1.47	—	.74	—	—	—
3	2.82	—	—	—	—	—	.08	—	—	—	—	.24
4	.93	—	—	—	—	—	1.48	—	—	—	—	.28
5	.15	—	.28	—	—	—	—	—	—	.39	—	.10
6	.48	—	.06	1.10	—	—	—	—	—	.11	—	.41
7	.20	—	.39	.04	—	—	2.21	—	—	.49	—	.06
8	.09	—	1.87	.03	—	—	2.06	20	.76	4.40	.25	.47
9	—	—	1.17	.26	.06	—	.73	—	1.28	—	—	—
10	—	—	1.79	—	—	.07	—	—	—	.45	—	—
11	—	—	.72	—	—	.59	—	—	—	.41	—	—
12	.71	—	.52	—	.11	.27	.34	—	—	.20	.02	.66
13	—	—	—	.36	.03	.22	.23	.10	—	.12	—	.73
14	—	—	.03	.25	.31	1.05	.38	1.10	—	—	1.33	—
15	—	—	—	.21	.06	—	.23	—	—	—	.03	.33
16	—	—	—	.12	—	—	.39	—	.46	.03	.07	—
17	—	—	.19	.23	1.16	.08	—	.52	—	—	—	—
18	.87	—	—	.41	.21	1.09	—	.23	.28	—	14	.25
19	.64	—	.07	—	—	1.89	—	—	—	—	3.59	.27
20	1.18	.40	—	.12	.25	.03	.10	.32	—	—	.15	—
21	.34	—	—	—	.05	—	—	.62	.25	—	1.23	—
22	.09	—	—	—	.70	—	—	—	.42	—	—	—
23	—	—	.04	—	.02	—	—	—	1.10	.15	2.01	.58
24	.28	—	.10	.02	.04	—	—	—	.24	.30	—	.24
25	.75	.05	—	.68	—	—	—	.04	.44	—	—	.67
26	.04	.83	.14	.57	.79	—	—	.08	1.03	—	.14	1.38
27	—	—	—	—	—	.01	—	—	.21	.21	1.62	.42
28	—	.25	.07	—	—	—	—	—	.02	—	—	—
29	—	—	—	1.15	—	.23	.24	.25	.21	2.08	.35	—
30	—	—	—	—	1.37	—	—	3.15	1.23	.19	.03	—
31	—	—	1.24	—	—	—	1.38	—	—	—	—	—
	9.57	4.12	10.60	6.94	5.16	5.53	11.32	6.64	8.70	9.56	12.05	6.97

Total for the year 97.16 inches.

## RAINFALL, IN INCHES, AT THE BOTANIC GARDENS, SINGAPORE

1934

	January	February	March	April	May	June	July	August	Sept.	October	Nov.	Dec.
1	—	—	.30	—	.02	—	—	—	1.82	—	1.88	—
2	—	—	.22	—	.08	—	—	—	2.57	—	.26	—
3	.10	—	.75	—	1.01	.05	—	—	.44	—	—	.66
4	.45	.19	.10	—	.10	—	—	.06	.09	—	.03	.51
5	.03	.48	.02	.09	.37	—	—	.18	.87	—	—	.03
6	3.70	.04	1.00	—	—	—	—	—	—	—	.24	.33
7	6.90	1.02	1.89	.02	—	—	—	—	—	—	—	.26
8	2.52	—	4.83	—	—	—	—	—	—	.21	.45	—
9	—	.03	—	—	—	—	.08	—	—	.30	.16	—
10	.10	.60	.71	.02	.06	.46	—	—	—	—	.06	—
11	.11	.42	—	1.10	.85	.20	—	.08	—	1.24	.61	—
12	.10	1.00	.85	.05	—	.39	—	—	—	.21	—	—
13	.25	—	.04	.95	—	.02	—	.06	—	.01	1.16	—
14	.70	—	.05	2.10	—	—	2.35	—	—	.70	1.92	—
15	.16	—	.25	—	.27	—	1.91	—	—	.15	.94	—
16	4.45	1.82	.21	.20	2.45	.06	.76	—	—	—	.41	—
17	.25	—	.58	—	.73	.04	.59	1.71	1.20	3.02	.26	.01
18	.02	.81	—	—	—	.11	.32	.04	—	.02	.37	—
19	.01	—	—	—	—	.02	.96	1.04	—	.12	.28	—
20	2.50	—	—	—	—	.71	—	.03	—	—	—	—
21	.11	—	.25	.84	—	.16	1.23	.23	99	.10	.07	—
22	—	—	.71	—	—	.07	—	.03	—	—	.02	—
23	—	.40	—	—	—	.15	.33	—	.03	—	4.02	.06
24	—	—	.05	—	—	1.60	.40	.42	—	—	—	—
25	—	.50	—	—	—	.09	1.81	.34	—	—	—	—
26	—	—	.27	—	—	—	.48	—	—	—	.24	.25
27	—	—	.47	.14	—	—	—	—	—	2.16	.44	.21
28	—	—	—	.26	.16	—	—	—	—	.02	.46	—
29	—	—	—	.04	—	32	—	—	—	.12	.69	—
30	—	—	—	—	—	—	—	3.56	.04	—	—	.20
31	—	—	.26	—	—	—	—	—	—	—	—	—
	22.46	7.31	13.87	5.81	6.10	6.07	11.68	7.75	8.05	8.38	14.97	2.58

## RAINFALL, IN INCHES, AT THE BOTANIC GARDENS, SINGAPORE

1935

	January	February	March	April	May	June	July	August	Sept.	October	Nov.	Dec.
1	—	—	.44	—	1.01	1.82	—	—	—	—	—	.92
2	—	—	.17	—	.16	.30	.90	—	—	.02	—	.52
3	1.45	—	.86	.66	—	.81	—	—	—	—	2.91	.28
4	.06	—	—	—	.46	.05	.14	—	—	—	1.11	—
5	.29	—	—	.06	—	—	—	—	—	.29	.02	—
6	.68	—	.81	.02	—	.53	—	—	—	—	—	.01
7	3.61	—	.07	—	1.73	—	—	—	—	—	.91	.03
8	1.37	—	.04	—	—	.21	.57	—	—	—	.10	—
9	—	—	.03	.13	—	—	—	—	.92	.04	—	1.33
10	—	—	.06	—	—	1.34	—	1.07	—	—	.30	—
11	—	—	.39	.25	1.70	—	—	—	—	—	—	—
12	—	—	—	.13	—	—	—	.23	—	—	.04	—
13	—	—	—	.42	—	—	.11	.26	.31	—	.91	1.56
14	.95	—	—	1.60	.14	—	—	.15	1.63	—	.23	1.86
15	—	.25	.14	.45	.28	.08	—	—	—	.21	—	1.74
16	—	1.17	.62	.02	1.08	.08	—	—	—	.22	.15	—
17	—	1.65	2.90	.06	—	.02	—	—	—	—	—	—
18	—	1.24	—	—	.02	—	—	.26	—	—	—	—
19	—	.15	—	—	—	1.12	—	.03	—	—	.33	.12
20	.16	.11	.13	.73	—	—	—	—	—	.59	.30	.09
21	—	.26	.37	—	.01	—	—	—	—	.14	—	.03
22	3.10	—	—	—	1.30	.59	1.01	.31	—	.16	1.02	.38
23	.55	—	—	—	—	—	—	—	—	.50	.02	1.71
24	—	—	.22	.02	.45	—	—	—	—	—	.10	.01
25	—	—	—	—	—	1.57	—	.02	.37	.26	—	.17
26	—	—	1.61	—	—	.14	—	—	—	1.68	.32	.57
27	—	—	.30	—	—	.05	—	.15	.29	.51	1.28	.13
28	—	—	1.02	—	—	—	—	.33	.13	—	.95	.02
29	—	—	—	.06	—	—	—	.21	.02	—	.03	1.32
30	—	—	—	.18	—	.07	—	—	—	—	.24	.33
31	—	—	—	—	—	—	—	—	—	—	—	1.35
	12.12	4.83	10.18	4.79	8.34	8.78	2.73	3.02	3.67	4.62	11.87	14.48

Total for the year 89.43 inches.

## RAINFALL, IN INCHES, AT THE BOTANIC GARDENS, SINGAPORE

1936

	January	February	March	April	May	June	July	August	Sept.	October	Nov.	Dec.
1	.24	—	—	.29	—	—	.09	.09	.05	—	.81	1.22
2	.01	—	—	.93	.28	—	—	—	—	—	1.38	.04
3	.09	1.43	—	—	.90	.07	—	.14	—	1.09	—	.01
4	.02	—	—	.24	—	—	06	—	—	—	—	.61
5	.99	—	.42	.49	.24	—	—	.17	—	—	.21	.28
6	.70	—	.32	.49	—	—	—	.71	.05	—	.21	—
7	.07	—	—	1.07	.89	—	2.74	.04	—	.31	2.48	—
8	—	.04	—	—	.09	—	—	.71	—	1.33	.84	.21
9	—	—	—	—	.89	—	—	.14	—	.36	—	.25
10	—	—	—	—	.07	.33	—	—	—	.61	—	—
11	2.44	—	.93	.07	—	.21	.74	—	—	—	—	—
12	.74	—	.64	.44	.46	—	—	.43	.06	—	.04	—
13	—	.04	.32	.07	—	—	—	—	—	—	1.05	.13
14	.04	.06	2.42	.47	—	—	.83	—	—	.17	—	.70
15	.21	—	.16	.32	.39	.29	—	.14	.14	—	—	—
16	—	—	.42	—	.32	—	—	.72	—	—	—	3.38
17	.03	.02	.11	—	1.24	—	—	.08	—	.73	2.72	—
18	—	—	.67	—	—	—	—	.43	.20	.20	.39	—
19	—	—	—	.45	.10	—	—	.04	.70	—	.02	—
20	.01	—	—	—	1.00	.34	—	.02	—	.35	—	.33
21	—	.02	—	.13	—	—	—	.22	—	.21	.10	—
22	.06	.08	3.16	—	.07	1.20	—	.52	.65	—	—	—
23	—	—	.03	.22	—	—	.16	—	.02	—	—	—
24	—	—	—	.59	—	.84	—	—	—	1.62	.19	—
25	—	—	—	—	.58	—	—	—	—	.61	.31	—
26	—	—	.16	—	—	—	—	.03	—	.15	2.15	1.07
27	.13	—	.20	—	—	—	—	.02	—	.01	.13	.01
28	—	—	—	—	—	—	—	—	—	—	.23	—
29	.91	—	—	—	—	—	—	—	—	—	1.52	—
30	.38	—	—	.87	—	—	—	.08	.04	1.86	.06	2.03
31	—	—	2.86	—	—	—	—	—	—	.16	—	—
	7.07	1.69	12.82	6.65	7.58	3.28	4.62	4.02	1.71	10.37	14.84	10.27

Total for the year 84.92 inches.

## RAINFALL, IN INCHES, AT THE BOTANIC GARDENS, SINGAPORE

1937

	January	February	March	April	May	June	July	August	Sept.	October	Nov.	Dec.
1	—	.86	—	—	—	—	—	—	.34	1.52	.37	.86
2	—	1.38	.01	—	—	—	.56	—	.06	—	—	.69
3	.35	—	.25	—	.05	—	—	—	.42	.05	—	.06
4	—	.04	—	.57	.10	—	—	—	.73	—	—	.05
5	—	—	—	.02	—	—	—	—	—	—	1.36	.37
6	—	—	—	.05	.78	—	.37	—	—	1.33	—	.65
7	—	—	—	1.06	—	2.00	.06	.12	—	.13	1.08	—
8	—	—	—	—	.37	—	—	.25	—	—	—	.42
9	.33	—	—	—	—	—	.83	—	—	—	.27	—
10	—	—	—	—	—	—	.06	—	—	—	.06	—
11	.69	.81	.05	1.01	—	.08	—	—	.53	—	—	—
12	3.89	—	1.22	—	.27	—	.58	.20	.31	.02	1.21	.95
13	—	—	—	.45	—	—	—	—	.02	—	—	.06
14	—	.63	—	.39	.10	—	—	.77	—	.04	—	—
15	.66	.72	—	—	.24	.07	—	1.31	.09	—	.40	1.80
16	1.70	.23	—	—	.20	.14	—	—	1.71	—	—	1.68
17	—	.63	—	.01	—	—	—	—	—	—	—	.47
18	—	.12	—	.36	1.20	—	—	1.17	—	—	.61	.92
19	—	—	.41	.26	.06	—	—	—	—	.33	1.83	.55
20	—	—	—	.15	—	—	—	.50	.07	.85	—	1.20
21	—	1.13	—	—	—	—	—	—	.80	.17	.21	.34
22	1.20	—	.02	.28	—	—	.06	—	.03	.02	.06	.76
23	—	—	.04	.33	—	—	.09	—	.17	—	.86	—
24	—	—	—	2.51	—	.68	—	—	.03	.40	.25	—
25	.92	.03	.02	.94	.08	.01	—	.34	1.51	.06	—	1.45
26	.33	—	—	—	—	—	—	—	.68	.72	—	—
27	.03	.28	2.04	—	3.16	.04	—	—	.04	.02	—	—
28	—	—	—	.64	—	—	—	—	—	—	—	—
29	—	—	—	.49	—	—	—	—	—	1.01	.35	—
30	—	—	.51	—	1.21	—	—	—	—	.09	—	.08
31	—	—	—	—	.34	—	—	—	—	—	—	—
	10.10	6.91	4.57	9.52	8.16	3.02	2.61	4.66	7.55	6.76	10.62	13.36

Total for the year 87.84 inches.

## RAINFALL, IN INCHES, AT THE BOTANIC GARDENS, SINGAPORE

1938

	January	February	March	April	May	June	July	August	Sept.	October	Nov.	Dec.
1	—	—	.23	.25	—	1.01	—	2.12	.11	—	—	—
2	1.23	1.08	—	.05	1.15	—	—	.51	—	.37	—	—
3	.39	.04	—	.37	.13	—	.19	—	—	—	—	—
4	—	—	—	1.16	1.16	—	—	—	.99	—	—	—
5	.02	—	—	.21	—	2.16	—	—	—	.67	—	.25
6	—	3.50	.25	.39	.19	1.82	—	—	.11	—	.96	.55
7	—	2.31	—	—	—	—	—	—	—	.06	.40	2.18
8	3.28	—	.20	—	—	—	—	—	—	—	.05	.02
9	—	.70	—	—	.03	—	.38	—	—	—	—	—
10	—	.20	—	.93	.24	—	—	—	—	.15	.07	.14
11	—	—	1.06	—	—	.05	.71	.04	.76	1.27	.25	.53
12	—	—	1.21	—	—	1.11	.23	.59	.26	—	—	—
13	—	.16	.19	.34	.17	—	.63	—	—	—	—	.73
14	—	—	—	—	—	.11	—	—	—	.16	.32	.42
15	.18	—	.55	—	—	—	—	.11	—	—	.03	—
16	—	—	.39	—	.39	—	—	—	—	—	.22	—
17	—	—	.19	—	1.51	—	—	.14	2.62	—	—	—
18	—	—	—	.02	—	—	—	.16	—	—	—	.33
19	.09	—	—	—	—	—	—	—	.18	.20	.02	.33
20	.09	—	1.35	.25	—	—	.10	.10	.72	—	.37	—
21	—	—	1.02	1.01	.06	—	—	—	—	—	—	—
22	—	—	—	—	—	.77	—	—	—	—	—	—
23	.10	—	—	.46	1.01	—	—	.27	—	1.01	.08	—
24	.35	—	.09	—	—	—	—	1.11	.02	.52	—	—
25	.77	—	—	—	—	—	—	—	—	2.37	—	—
26	.10	.10	.17	1.22	—	—	—	—	—	.22	—	1.18
27	2.79	.70	.04	.91	—	.61	—	—	—	.03	1.02	.07
28	.08	.38	—	—	.61	—	—	—	1.57	—	.16	.07
29	.19	—	—	.07	—	—	—	—	—	—	—	—
30	.07	—	1.28	—	—	.91	—	—	—	—	—	—
31	.52	—	.38	—	—	—	—	1.78	—	.15	—	—
Total	10.25	8.88	8.80	7.64	6.65	8.55	2.14	6.03	8.34	7.03	6.25	9.20

Total for the year 90.66 inches.

## RAINFALL, IN INCHES, AT THE BOTANIC GARDENS, SINGAPORE

1939

	January	February	March	April	May	June	July	August	Sept.	October	Nov.	Dec.
1	.02		.28					.07	.83	.08	1.41	1.88
2	.11					.09	.41	.41				
3		.71	1.54			.32			.05	.17	.04	
4			.77	.01						1.38		
5	.02	1.18		.68								.21
6		.15		.52					.45			.14
7	.42	.49			.20	.99	.36	.75		.36	1.76	.34
8		.11	.08	2.98	.49			3.75			.09	
9			.27		1.00			.01				.27
10						1.66				1.68	1.02	
11								.10		1.01	.16	
12				.45	.45		.22		.83	1.03	1.13	.11
13	.94			.13	.53				1.76	.37		
14				.53					.07		.03	7.63
15						.38		1.82	.45	.58		.68
16					.82	.06		.07				2.27
17	.12						1.21	1.33	.28	.22	.06	
18								1.18	.70	.63		
19	.55		.20			1.55						
20	.51								.22	.19	.19	.13
21		.57							.03			
22	.12	.44								.19		
23	.44						.07		3.89	.23	1.23	
24	1.11	.05						.02				
25	.08					.13	.35	.09				.04
26	.14		.53	.92	.92					.27		
27	.04	1.73						1.70		.34	1.47	.005
28						.02		.21				
29							.90				1.14	
30			.78	.55			.77	.38		.53		.08
31	2.22							2.01				
	7.44	5.48	4.45	7.59	4.54	5.20	4.29	15.90	9.56	8.66	9.73	13.78

Total for the year 96.57 inches.



# THE GARDENS' BULLETIN STRAITS SETTLEMENTS

Vol. XI

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Part 3

## NOTES ON THE SYSTEMATY AND DISTRIBUTION OF MALAYAN PHANEROGAMS, IV: IXORA

By E. J. H. CORNER,  
*Botanic Gardens, Singapore*

After studying for several years the living plants of *Ixora* in Malaya, I find that the two most valuable guides to the affinity, and therefore to the identification, of the species are the colour of the corolla and the fragrance or scentlessness of the flower. After these one must have recourse to the size of the bracts and sepals and the shape and venation of the leaf. The size and hairiness of the corolla and even the shape of the petals I find to be most variable and, for the majority of the Malayan species, by no means specific. But the most important character of the genus is found in the structure of the inflorescence, whether its branches are articulate or not, because this criterion distinguishes *I. grandifolia*, with its inarticulate inflorescence falling off in one piece, from all other Malayan species. It is a primitive mark that connects *Ixora* with such genera as *Pavetta* and *Tarenna*.

It seems that the extraordinary variability in the size of the leaf and corolla is not appreciated. From the most recent works on the genus (Craib, Bremekamp) the impression is gained that many new species can be blocked out from the old and that minute differences in hairiness, leaf-size, or shape, and length of corolla-tube suffice to define them. But I am certain that this view is mistaken and, if followed, must lead to the making of so many "species" that the classification of the genus will become impossible. Such splitting, based on relatively few herbarium specimens, merely obscures the issue which is to have names for the major, well-defined groups of individuals. Moreover, through limitation to the herbarium, many equally variable and important characters such as the colour of the flowers and the shininess of the leaves must be omitted, though from such features the living plants are most easily recognised. If it is permissible to make species on the

size of the leaf, so it is on the colour of the corolla e.g. *I. candida* and *I. lutea*. But the more one studies the wild plants the more one will encounter intermediates between the microspecies of the "splitters". For example, a good case might be put forward for uniting *I. chinensis*, *I. javanica*, *I. congesta*, *I. Lobtii* and *I. Robinsonii* because there are a few plants which cannot be classified as one or the other, but can be referred equally well to two of the species. To the field botanist in Malaya, *Ixora* is clearly in a 'state of evolution' comparable with that of *Rubus*, *Rosa*, or *Oenothera* and, systematically, as complicated. We must, therefore, compromise between the needs of the field-botanist and the scruples of the herbarium to procure a satisfactory classification.

To prove my point, I have defined the Malayan species in the widest possible sense and, under the red-flowered species, have indicated to some extent their variation by numbering the recognisable forms. It will be seen that these show such gradation that none can be separated as a species e.g. *I. javanica* with the corolla varying from 2-5 cm. long, 1-2.5 cm. wide, and from a basic yellow through pink to deep red. That these continuous variations should have been overlooked by previous authors must throw grave doubts on the value of their classifications. Certainly the keys of King, Ridley and Pitard are impracticable. I believe that by combining all such variable characters as the size, shape, texture, colour, shininess and venation of the leaf, the length of the stipule, petiole and peduncle, the variation in size of the corymbs and flowers and the colour of the petals, no less than a hundred 'forms' of *I. javanica* could be detailed for Malaya alone. And how many of these characters and combinations of characters would be hereditary? I think that the main species of *Ixora* are known. It is now time for the field-botanist and the geneticist to explore their variation.

I have not attempted to dissect Bremekamp's latest paper on the Malaysian species (Bull. Jard. Bot. Buit. ser. 3, vol. 14, 1937). I doubt if anyone will be prepared to struggle through so much detail before the name of a species can be found. The classificatory value of the details I consider so dubious and trivial that I would regard most of Bremekamp's species as forms of subspecies and his series as species, did our study of these forest plants usefully extend to such fractionising. If so many "species" can be recognised in the herbarium, what is to become of the genus when we shall have reckoned also with all the characters that disappear from the living plants on drying? If the length of the rudimentary sepals is so important or the

excursion of a few epidermal cells on the style into macroscopic vision, then so are the sliminess of the root-cap, the rate of mitosis, the latent period of tropism, the glitter or convexity of the epidermal cells and the exact tint of the young leaf. I disagree so profoundly with unargued "splitting" that I leave it to others to consult this new language.

## KEY TO IXORA IN MALAYA

Corolla white or greenish white: fragrant ..	Group A
Corolla, with pink or reddish tube and white or pinkish petals, not changing colour: flowers often fragrant: wild .. ..	Group B
Corolla wholly yellow, red or, occasionally, pink, mostly with yellow or orange petals changing to red: mostly scentless (all cultivated, coloured Ixoras) .. ..	Group C

## GROUP A

Sepals more or less leafy, at least twice as long as the ovary	
Dwarf shrub with ovate red sepals: wild ..	<i>I. clivodendron</i>
Medium to tall shrubs or small trees: sepals green or pinkish	
Sepals 2-3.5 mm. long: leaves rather narrow and blunt, with 6-9 pairs of side-veins: cult. ..	<i>I. finlaysoniana</i>
Sepals 3-12 mm. long: leaves medium to broad, pointed, with 10-20 pairs of side-veins	
Sepals 3-6 mm. long: wild ..	<i>I. umbellata</i>
Sepals 6-12 mm. long: cult. (? wild) ..	var. <i>multibracteata</i>
Sepals linear, triangular or toothlike, not leafy, shorter than the ovary or not more than twice as long (except <i>I. Brunonis</i> )	
Stems, infloresc. and undersides of leaves hairy: veins 10-20 pairs	
Dwarf shrub: leaves narrowed to the distinct stalk: corolla glabrous ..	<i>I. pumila</i>
Medium-sized shrub: leaves more or less cordate, sessile or indistinctly stalked: corolla hairy ..	<i>I. Brunonis</i>
Glabrous: leaves drying blackish	
Blade tapered to the base: corolla-tube .8-1.3 cm. long ..	<i>I. nigricans</i>
Blade generally broadly rounded at the base: corolla-tube 2-3 cm. long ..	var. <i>ovalis</i>

## GROUP B

Inflorescence upside down, the branches jointed: flowers not fragrant .. ..	<i>I. pendula</i>
Inflorescence erect or not bent down, the branches not jointed: often fragrant	
Blade elliptic, ovate or obovate with distinct veins .. ..	<i>I. grandifolia</i>
Blade lanceolate, rather thick, with indistinct veins .. ..	var. <i>lanceifolia</i>

## GROUP C

- Corolla-tube less than 1.5 cm. long: fragrant:  
wild
- Flower-clusters 2-5 cm. wide: corolla-tube  
8-12 mm. long: lowlands .. *I. concinna*
- Clusters 6-20 cm. wide: tube 3-9 mm. long:  
mountains .. *I. micrantha*
- Corolla-tube more than 1.5 cm. long: not  
fragrant
- Sepals 2-5 mm. long, longer than the ovary,  
rather leafy
- Flowers yellow-red: leaves not cordate:  
wild .. *I. Kingstonii*
- Flowers pink: leaves often cordate:  
cult. .. *I. coccinea* var. *rosea*
- Sepals .5-1.5 mm. long, triangular, tooth-  
like, shorter than the ovary
- Leaf more or less sessile, the base  
narrowly to widely cordate, at least  
on the vegetative shoots
- Leaf 5-18 cm. wide: infloresc.  
branches red: petals blunt:  
wild
- Dwarf shrub  $\frac{1}{2}$  m. high:  
leaves crowded .. *I. Scortechinii*
- Spindly shrub 1-2 $\frac{1}{4}$  m. high:  
leaves well-spaced .. var. *caulescens*
- Leaf 1-7 cm. wide: infloresc.  
branches green: petals pointed:  
cult.
- Flower red or orange turning  
red
- Leaves acute: petals  
lanceolate-elliptic .. *I. coccinea*
- Leaves often blunt: petals  
ovate-elliptic .. var. *bandhuca*  
var. *lutea*
- Flowers yellow, unchanging
- Petals yellow fading to pale  
pinkish white .. var. *decolorans*
- Petals yellow then streaked  
with rose-pink .. var. *aureo-rosea*
- Petals pink, turning deep clear  
pink .. var. *rosea*
- Leaf stalked, the base never cordate:  
infloresc. branches mostly red
- Leaf-stalk 1-3 mm. long:  
cult.
- Leaves small, narrow,  
.7-2.5 cm. wide: petal.  
pointed .. *I. "Sunkist"*  
p. 235
- Leaves rather blunt, 2-2-  
6.5 cm. wide: petals  
blunt
- Corolla 1.4-1.6 cm.  
wide, tube 3-3.5  
cm. long .. *I. chinensis*

- Corolla 1-1.2 cm.  
wide, tube 1.8 cm.  
long .. ..
- Leaf-stalk 3-20 mm. long:  
wild or cult.
- Riverside shrubs with  
lanceolate leaves .7-.3  
cm. wide
- Leaves glossy: side-  
veins 8-15 pairs,  
distinctly inarching  
near the margin ..
- Leaves rather dull:  
side-veins 6-10  
pairs, not inarching
- Not riverside: leaves 3-15  
cm. wide
- Mountain shrub of  
the Tahan neigh-  
bourhood (Ulu Pa-  
hang, Trengganu,  
Kelantan): leaves  
leathery, very gra-  
dually tapered into  
the stalk: petals  
pointed ..
- Leaves scarcely lea-  
thery: stalk always  
distinct from the  
blade
- Leaves with 14-26  
pairs of side-  
veins, distinctly  
inarching
- Leaf rather nar-  
rowly elliptic to  
narrowly ob-  
ovate, acumi-  
nate, up to 8.5  
cm. wide: side-  
veins 14-26  
pairs: petals  
acute ..
- Leaf rather  
broadly elliptic,  
up to 15.5 cm.  
wide: side-veins  
13-19 pairs:  
petals mostly  
blunt ..
- Leaves with 6-14  
pairs of side-  
veins, up to 11.5  
cm. wide
- Side-veins 6-12  
pairs, distinctly  
inarching ..
- var. *dixiana*
- I. Lobbii* var.  
*stenophylla*
- I. javanica*
- I. Robinsonii*
- I. Lobbii*
- I. congesta*
- I. javanica*
- var. *retinervia*

Side-veins	not	
inarching		
Side-veins	9-	
14 pairs	..	var. <i>multinervia</i>
Side-veins	6-9	
(-10) pairs		var. <i>paucinervia</i>
Flowers buff-		
yellow or		
pale orange		
buff	..	"Yellow Javanica"
Flowers yellow		
low then		
clear pink,		
never red		"Pink Javanica"
Flowers yellow		
low turning		
reddish		
pink or red		"Red Javanica"

# I. amoena Don

Gen. Syst. 3, 1814, p. 571.

Typus:—

Wallich 6121 D, E, F, (Penang): fide Hooker.

Interpretations:—

Hooker, F.B.I. 3, p. 146.

Pitard, Fl. Gen. Indoch., 3, p. 328.

Craib, Fl. Siam. En., 2, p. 149.

Misinterpretations:—

King and Gamble, Mat. Fl. Mal. Pen. 4, p. 154 as *I. stricta* Roxb.

Ridley, Fl. Mal. Pen. 2, p. 94, as *I. stricta* Roxb.

Synonyms:—

*Ixora stricta* var. *amoena* Ridley, Fl. Mal. Pen. 2, 1921, p. 94.

From the published descriptions, it is impossible to see how *I. amoena* differs from *I. javanica*. The latest opinion is that of Craib who states that *I. javanica* has longer stipules, but, as he gives not the length of stipule in either, one cannot appreciate the difference. In *I. javanica* I find that the stipular point varies from 1-8 mm. even on the same plant but that it is generally long in plants growing in shady places, especially by riversides, and short in plants in the full open. Hooker says that *I. amoena* has a laxer habit and "longer, lanceolate, more membranous leaves" with more distinct petioles than *I. javanica*. Pitard copies Hooker. King and Gamble remark that only a slight difference in reticulation of the leaves distinguishes *I. amoena* from *I. javanica* (= *I. stricta* in their sense). Ridley distinguishes his variety *amoena* by the more coriaceous leaves in contradiction to Hooker, though both cite Wallich's collection. In the following list of identified specimens, a still greater variety of treatment will be discovered. Hence I regard *I. amoena* as a synonym of *I. javanica*.

IDENTIFIED SPECIMENS OF *I. AMOENI* IN THE SINGAPORE HERBARIUM

Craib's identifications:—

Keith 129 (= *I. javanica* form 1): Kiah 24360 (= *I. javanica* form 2). Haniff and Nur 3910 (= *I. javanica* form 9): Curtis 2607, Ridley 8354 (= *I. javanica* form 10): Ridley 14998 (= *I. javanica* form 23): (evidently Craib has not considered the variation in flower-size).

British Museum's identification:—

Robinson and Kloss, Korinchi Exp. 19.3.14 (= *I. javanica* form 29).

Merrill's identifications:—

Moulton 6703/15 (= *I. Lobbii* form 3): (almost identical specimens from the Anamba and Natuna Islands, v. Steenis 897 and Henderson 20185, are determined by v. Steenis as *I. javanica*).

Winkler 2154 (= *I. javanica* var. *retinervia*, probably).

**I. Brunonis Don**

Gen. Syst. 3, 1834, p. 573.

A shrub up to 3 m. high: twigs, corymbs and undersides of leaves rather closely hispid-hairy, uppersides of leaves soon glabrous.

Leaf-blade 14–31 × 4–10.5 cm., lanceolate-obovate, or nearly oblong, cuspidate-acuminate, the base narrowly to rather broadly cordate, membranous: side-veins 11–17 pairs, more or less inarching near the margin: petiole 0–5 mm. long, very short, hispid: stipular point 9–20 mm. long, filiform.

Corymb 6–12 cm. wide, generally dense and sessile, or with a peduncle up to 2 cm. long, the bracts, sepals, branches and corolla hispid hairy: bracts 5–10 mm. long, filiform: flowers white, fragrant: sepals 2.5–5 mm. long, filiform: corolla-tube 3–4 cm. long, the outside of the tube and the mouth hairy: petals 6–9 mm. long × 2–3 mm. wide, oblong, acute, hairy on the outside.

Distribution:—Burma, Siam, North Malaya (Penang, Upper Perak, Kedah).

Type:—Wallach 6136 (Penang).

Very little is known about this species which appears to be rather rare. The oblong-obovate, cuspidate, hairy leaf with almost sessile, cordate base is distinctive.

**I. chinensis Lam.**

Chinese *Ixora*

Encycl. 3, 1789, p. 344.

Synonyms:—

*I. stricta* Roxb. Hort. Beng. 1814, p. 10: Fl. Ind. 1, 1820, p. 388: Fl. Gen. Indoch. III, p. 326: *haud sensu* Hooker, King, Gamble, Ridley.

*Flammia silvarum peregrina* Rumph. Herb. Amb. 4, p. 107, t. 47.

Icones:—

Rumphius loc. cit.

Curtis, Bot. Mag. t. 169 (as *I. coccinea*).

Wight, Ic. t. 184 (as *I. stricta*).

Bot. Reg. t. 782 (as *I. crocata*).

Typus:—

Sonnecrat, spec. sinense, in Herb. Lam.

A glabrous shrub, ? flowering all the year in Malayan countries.

*Leaf-blade* 4-15.5  $\times$  2.2-6.5 cm., elliptic, lanceolate-elliptic or narrowly obovate, *subacute or blunt*, tapering gradually to the suddenly rounded narrow base or even narrowly cordate, not amplexicaul, *subsessile*, more or less coriaceous, rather dull green often yellowish green, with 6-10 pairs of side-veins not or indistinctly inarching: *petiole* 1-3 cm. long: stipular point 1-3 cm. long.

*Corumb* 5-10 cm. wide, dense, sessile or with a peduncle up to 1.5 cm. long, *with crimson, articulate branches*; sepals blunt to subacute, shorter than the ovary: corolla-tube 3-3.5 cm. long, the limb 1.4-1.6 cm. wide, *the petals broadly elliptic or orbicular, very blunt with the edges not or scarcely recurved, apricot yellow turning brick red.*

*Distribution*:—S. China, Indochina: elsewhere introduced.

I follow Merrill in his interpretation of this species (Interpr. Rumph. Herb. Amb. p. 187) though he did not give botanical evidence or a description of the species that he had in mind. But the small, subsessile, blunt, few-veined leaves and extraordinarily blunt, broad petals, which make the flower look very full, readily distinguish it and by this means one can certainly unite the plants of Rumphius, Lamarck and Roxburgh. Pitard's description (Fl. Gen. Indoch.) corresponds exactly.

Whether *I. chinensis* is specifically distinct from *I. javanica* I do not know. The very short petiole of *I. chinensis* appears to be the only diagnostic character. A critical study of the wild species in Siam and Indochina (cf. *I. amoena* sensu Pitard) is much needed. *I. crotata* Lindley, which has always been referred to *I. stricta* sensu Hooker (= *I. javanica*), seems to me unquestionably *I. chinensis*. Whether the illustration of *I. javanica*, Bot. Mag. t. 4586, represents *I. javanica* or *I. chinensis* I cannot decide.

On the other hand, *I. chinensis* has been often mistaken for *I. coccinea* and it seems that it still is. The more or less amplexicaul leaf-base and pointed petals distinguish *I. coccinea*, but fragmentary herbarium specimens may not be easy to identify because the leaves on short flowering stems may be reduced and have a base more like that of *I. chinensis*. Moreover, the garden variety called *I. dixiana* is referred in the Index Kewensis to *I. coccinea* though it is certainly a dwarf form of *I. chinensis*. *I. dixiana*, in fact, differs from *I. chinensis* only in its dwarf habit ( $\frac{1}{2}$ -1 m. high) and small flowers (corolla-tube 1.8 cm. long, limb 1-1.2 cm. wide). I am inclined to think that the plant called by the garden name "Sunkist" in this paper is a hybrid between *I. chinensis* and *I. javanica* or *I. Lobbii*. I have seen no published description that would fit it.

*I. stricta* Roxb. sensu Hooker, King and Ridley is *I. javanica*.

**f. clerodendron Ridley**

Trans. Linn. Soc. 3, 1893, p. 311.

A small, little branched shrub; young parts pubescent.

Leaf-blade 23 × 9 cm., lanceolate or obovate, narrowed to both ends, glabrous above, pubescent beneath: stipules 1.2 cm. long, triangular subulate.

Corymb 2.5 cm. wide, dense, pubescent, many-flowered: flower white: sepals 6 mm. long, ovate, pubescent, longer than the ovary, red: corolla-tube 2.5 cm. long: petals 3 mm. long, oblong-ovate, subacute, white.

Fruit 6 mm. long, grey with red-streaks, crowned with the red sepals.

Distribution:—Pahang (Malaya).

Type:—Ridley's specimen from Kuala Tembeling.

This description is taken from Ridley's. There is no specimen in the Singapore Herbarium. The species must come very close to *I. pumila* which differs in the smaller, lanceolate sepals and relatively broader leaves. I suspect that they may be identical. Both are from the same district of Pahang.

**I. coccinea L.**

Indian *Ixora*

Sp. Pl. 3rd Ed., 1764, p. 159. (excl. synonym.).

Synonyms:—

*I. grandiflora* Br., Bot. Reg. t. 154.

Icons:—

Bot. Reg. t. 154 (as *I. grandiflora*).

Wight lc. t. 153 (as *I. coccinea*).

A shrub or treelet to 4 m. high, flowering throughout the year, glabrous except the puberulous branches of the corymb.

Leaf-blade 3.5–13 × 1–7 cm., elliptic, varying blunt to acute, the base more or less widely cordate and amplexicaul, sessile or shortly stalked, (often narrowly cordate or broadly rounded and shortly stalked on short flowering twigs), rather dark shiny green, scarcely coriaceous: side-veins 9–14 pairs, inarching near the edge: petiole 0–7 mm. long: stipular point 2–7 mm. long.

Corymb 5–10 cm. wide, sessile or with a short peduncle up to 2.5 cm. long, the branches puberulous, articulate, green, the flowers in trichasia the central one generally sessile, the laterals shortly stalked: sepals broad, subacute, reddish, shorter than the green ovary; corolla-tube 2–3.5 cm. long, the limb 1.3–3 cm. wide, the petals 2–8 cm. wide, lanceolate-elliptic, acute, pinkish yellow or reddish pink with orange base turning blood red or crimson.

Distribution:—N.E. India, China, Indochina; elsewhere introduced.

Type:—Osbeck's specimen of the Flora Zeylanica.

**var. bandhuca**

*Ixora Bandhuca*

Syn. *I. bandhuca* Roxb. Fl. Ind. I, 1820, p. 386.

Wight lc. t. 149 (copy of Roxburgh's drawing of *I. bandhuca*).

Bot. Reg. t. 513.

A bushier, more spreading shrub: *leaves obtuse or sub-acute: petals 8-10 mm. wide, ovate-elliptic, rather suddenly pointed, not lanceolate-acute, hence the flower fuller: corolla-tube 3.5-4 cm. long, limb 2.5-3 cm. wide.*

Distribution:—Hindustan.

**var. lutea**

Yellow Coccinea

Syn. *I. lutea* Hutchinson Bot. Mag. t. 8139.

Petals buff-yellow, unchanging or fading pale yellow, never reddening, ovate-elliptic: sepals green: corolla-tube whitish.

Origin:—Royal Botanic Gardens, Peradeniya, Ceylon.

**var. decolorans var. nov.**

Pallid Coccinea

Lamina semper minore, 2.5-7.5  $\times$  1.5-3.8 cm., elliptica, *acuta, basi anguste cordata*, (laminis ramulorum floriferorum saepe vix cordatis vel cuneatis), costis lateralibus utrinsecus 7-12: petiolo 1-2 mm. longo.

*Floribus luteis dein roseo-pallescentibus vel albido-roseis; corollae tubo albido, 2.7-3.1 cm. longo; corollae limbo 2-2.3 cm. lato, petalis .6-7 cm. latis, ovato-ellipticis, acutis.*

Origin:—horti?

Typus:—frutex in hort. bot. Singap.

**var. aureo-rosea var. nov.**

Gold Coccinea

Petalis luteis dein marginem versus roseis vel roseo-striatis, semper aureo-roseis, nunquam coccineis, late ellipticis, acutis, 7-8 mm. latis: corollae tubo 4-4.5 cm. longo, pallide roseo-luteo, limbo 2.7-3 cm. lato.

Origin:—horti?

Typus:—frutex in hort. bot. Singap.

**var. rosea var. nov.**

Pink Coccinea

? *Pavetta incarnata* Bl. Bijdr., 1825, p. 950.

*Floribus roseis, primo pallide roseis, nec rubris nec luteis: sepalis 2-2.5 mm. longis, late lanceolatis, foliaceis, roseo-marginatis, ovario longioribus: corollae tubo 1.5-2.5 cm. longo, pallide roseis, limbo 1.2-2.3 cm. lato: petalis .2-6 cm. latis, oblongo-ellipticis, acutis vel subacutis, proxime marginibus recurvatis: ovario 1-1.5 mm. longo, virido: ramulis inflorescentia viridis.*

Origin:—?

: cult. in Malaya.

Typus:—Corner 34514 (Woodleigh Nursery, Singapore, 5.11.37 = Form 8).

*I. coccinea* was, and perhaps still is, confused with *I. chinensis*, as I have mentioned under that species. But the description of Linnaeus indicates how *I. coccinea* must be interpreted, that is "*foliis ovalibus semiamplexicaulibus*", and in this wide sense it is a useful species. I have often observed that the leaves on flowering twigs incline to the shape of those of *I. chinensis* so that such a twig by itself may be difficult to distinguish from one of *I. chinensis* except for the pointed petals. However, amplexicaul cordate leaves can always be found on sterile shoots of *I. coccinea* and never on those of *I. chinensis*, or indeed, of any

other red-flowered species in the sense in which I understand them. I believe also, that one may find that *I. coccinea* has always green and *I. chinensis* red corymb-branches.

*I. bandhuca* seems not to be recognised nowadays. From dried specimens it is no doubt difficult, but with the living plants it is easy. The difference from *I. coccinea* is well shown in Wight's two plates which are copies of Roxburgh's drawings. The distinctions are, however, merely varietal. The var. *bandhuca* is the commonest variety of *I. coccinea* in Malaya.

*I. lutea* is clearly only a colour-variety of typical *I. coccinea*, in which the red colour does not develop. Hence I have reduced it to varietal rank. The amplexicaul leaves distinguish it from the yellow variety of *I. javanica*.

The var. *decolorans* is proposed for a bush growing in the Singapore Botanic Gardens and which has been mistakenly called *I. bandhuca* for many years. I have not found a description of it. The washed-out colour of the flower is not beautiful.

The var. *aureo-rosea* I propose for another plant growing in the Singapore Botanic Gardens, and believed to have been introduced from Kew. I can find no description of it either. It is a magnificent, free-flowering plant of considerable vigour for which a name has long been needed.

The variety *rosea* is probably *Pavetta incarnata* Bl. of which there is no modern or ample description. It has the sessile amplexicaul, pointed leaves typical of *I. coccinea* on the vegetative shoot, but those on the flowering shoots have generally a simple, rounded base suggesting that of *I. javanica*. The sepals offer the only discrepancy in identifying the variety with *I. coccinea*, the sepals of which do not exceed the ovary in length, but a specific value can hardly be attached to this feature when the overwhelming similarity with *I. coccinea* in other respects is borne in mind. I do not find that a pink variety of *I. coccinea* has been described and as this is a frequent plant in Malayan gardens it is in need of a name. If *I. rosea* Wallich (Bot. Mag. 2128, Bot. Reg. 510) is correctly identified with *I. stricta* sensu Hooker (= *I. javanica*) then it cannot be my var. *rosea*, though t. 2128 is very suggestive of it, excepting the pubescence.

What I have called *I. coccinea* form 1 has been grown for several years in the Singapore Botanic Gardens as *I. oculata*, which name I cannot find in botanical literature.

As I have remarked under *I. chinensis*, the garden species *I. dixiana* is a variety of it and not of *I. coccinea* as stated in the Index Kewensis.

KEY TO THE FORMS AND VARIETIES OF *I. COCCINEA*

Petals red	
Petals lanceolate elliptic, attenuate, 2-8 cm. wide	<i>I. coccinea</i>
Corolla-tube 2-2.5 cm. long	
Limb 1.3-1.6 cm. wide: petals 2-3 cm. wide	Form 1
Corolla-tube 3-3.5 cm. long	
Limb 1.5-1.7 cm. wide, petals 4-5 cm. wide	Form 2
Limb 2-2.3 cm. wide: petals 5-6 cm. wide	Form 3
Limb 2.7-3 cm. wide: petals 6-8 cm. wide	Form 4
Petals ovate elliptic, rather suddenly pointed, .8-1 cm. wide	var. <i>bandhuca</i>
Petals yellow, never reddening	var. <i>lutea</i>
Corolla-tube 3.2-3.7 cm. long: limb 2.4-2.7 cm. wide: petals .6-.8 cm. wide	Form 5
Corolla-tube 4-4.5 cm. long: limb 2.7-3 cm. wide: petals .8-.9 cm. wide	Form 6
Petals yellow, fading pale pinkish white	var. <i>decolorans</i>
Petals yellow then streaked with rose, rather broad	var. <i>aur-o-rosa</i>
Petals pale pink turning deep pink, never red or yellow, oblong elliptic	var. <i>rosea</i>
Corolla-tube 1.5-1.8 cm. long: limb 2-2.3 cm. wide: petals .5-.6 cm. wide, subacute	Form 7
Corolla-tube 2-2.5 cm. long: limb 1.2-1.5 cm. wide: petals 2-3 cm. wide, acute with a minute mucro	Form 8

***I. concinna* Hook. f.**Trogon *Ixora*

F.B.I. 3, 1880, p. 147.

A small to medium-sized tree up to 20 m. high: *wholly glabrous*.

Leaf-blade 6.5-18 × 2-7 cm., elliptic, tapered to each end, more or less acuminate, membranous or subcoriaceous: *sit-c-vins* 8-13 pairs, distinctly inarching: petiole .2-1.2 cm. long.

Corymb 2.5-5 cm. wide, sessile or on a short peduncle up to 1.2 cm. long, the branches slender 1 mm. wide or less, articulate, glabrous (? red or green): *sepals* .5-2.5 mm. long, lanceolate-triangular, *variable in size*, shorter than the ovary, as long as or longer than in different collections, never leafy: *corolla-tube* 8-12 mm. long, *short, yellowish pink to reddish pink*: *corolla-limb* .7-1 cm. wide, *the petals acute, yellow turning pinkish and finally dull-red*, or partly red: ovary 1-1.5 mm. long: *flowers fragrant*.

Fruit .7-1 cm. wide.

Distribution:—Malaya, Sumatra, Borneo.

Type:—Wallich 6149 (Singapore).

This is one of the less variable *Ixoras*. It is distinguished by its small leaves and flower-clusters and its fragrant flowers. The variable features are the texture of the leaf and the length of the sepals. The leaf may be membranous or distinctly coriaceous, perhaps dependent on the size of the tree and its situation. The sepals may be shorter than

the ovary or considerably longer or of intermediate length, their length being fairly constant in each collection. Although this variation seems to have escaped the attention of botanists, so that we have been spared from numerous micro-species which would have made the identification of the trees impossible until one had seen the sepals, the range of variation is greater than that of any other species, being 5 times the minimum length of the sepals.

*I. concinna* has been mistaken in the Singapore Herbarium and in Ridley's Flora for my *I. javanica* var. *retinervia* from which it differs in its smaller, fragrant flowers, less pointed leaves with the veins making a more acute angle with the midrib and not so distinctly inarching, its laxer and more slender inflorescence branches (2 mm. wide in *I. javanica* var. *retinervia*) and smaller fruits (1-1.3 cm. wide in var. *retinervia*).

### *I. congesta* Roxb.

Malayan Ixora

Fl. Ind. 1, 1820, p. 397.

Synonyms:—

*I. Griffithii* Hook. Bot. Mag. 1841, t. 4325.

*I. fulgens* Roxb. sensu Hook. fil. F.D.I. 3, 1880, p. 146.

An evergreen shrub or small tree like *I. javanica* but:—  
*Leaf-blade* generally larger or broader, 13-31 × 5-15.5 cm wide, with more numerous, stronger lateral veins (13-19 pairs) generally with distinctly inarching marginal loops.

*Sepals* blunt to acute, generally acute.

*Petals* yellow or pinkish yellow turning red, generally blunt to subacute.

Distribution:—W. Malaysia to the Moluccas.

Bremekamp has recently substituted the name *I. Griffithii* for Malayan plants which have been referred to *I. congesta* (Journ. Bot. 75, 1937, p. 169). Roxburgh described *I. congesta* from a plant growing in the Calcutta Botanic Gardens and said to have been derived from the Moluccas. There is no type and the description is brief. Hence Bremekamp writes of it "species moluccana dicta, parum descripta et absentia typi haud certe noscenda, dubiosissima". Why then did Hooker reduce *I. Griffithii* to *I. congesta*, in which he was followed by Kurz, King, Gamble, and Craib? I think that Bremekamp has overlooked the traditions of Indian Botany which were handed from Roxburgh to Hooker through the succession of Superintendents of the Calcutta Botanic Gardens and through Roxburgh's own circle of botanists, of which Wight and Arnott have given us the picture. As no reason is advanced for rejecting this long-standing interpretation of *I. congesta*, one must continue to employ it in accordance with the Rules of Nomenclature. *I. fulgens* offers a parallel case where the full description of Rumphius should enable

one to identify Roxburgh's species, but Bremekamp denies the Moluccan origin of *I. fulgens*.

Merrill has identified *I. congesta* with *I. fulgens* but, as I have shown under that species, nobody has yet identified *I. fulgens* (Enum. Philipp. Fl. 3, p. 548). Rumphius' plate, which is the type of *I. fulgens*, shows an *Ixora* with pointed petals. The only form of *I. congesta* with pointed petals is my form 9 and that most botanists would probably not admit as *I. congesta*.

Although it is generally easy to distinguish *I. congesta*, *I. Lobbi* and *I. javanica*, there are collections in the Singapore herbarium which connect them as I have mentioned under those species. What I have called *I. congesta* form 9 is especially problematic.

#### KEY TO THE FORMS OF *I. CONGESTA*

- Corolla-tube 3.7-4.5 cm. long  
 Limb 1.5-1.8 cm. wide: petals 4-5 cm. wide, blunt to subacute .. .. Form 1  
 Limb 1.8-2.1 cm. wide: petals 5-6 cm. wide, subacute .. Form 2  
 Corolla-tube 2.5-3.8 cm. long  
 Limb 1-1.3 cm. wide  
 Petals 3-4 cm. wide, subacute .. .. Form 3  
 Petals 5-7 cm. wide, blunt .. .. Form 4  
 Limb 1.4-1.8 cm. wide: petals blunt to subacute  
 Petals 3-5 cm. wide .. .. Form 5  
 Petals 5-7 cm. wide .. .. Form 6  
 Limb 1.8-2.1 cm. wide  
 Petals 3-5 cm. wide, subacute .. .. Form 7  
 Limb 2-2.8 cm. wide: petals 5-7 cm. wide  
 Petals blunt to subacute .. .. Form 8  
 Petals acute .. .. Form 9  
 Limb 2.5-3.8 cm. wide: petals blunt to subacute  
 Petals 5-7 cm. wide, orange yellow then red: limb  
 2.5-3.8 cm. wide: veins of leaf 9-14 pairs .. Form 10  
 Petals 7-8 cm. wide, pale yellow then salmon pink:  
 limb 2.5-3 cm. wide: veins of leaf 14-19 pairs .. Form 11

#### Form 1

Corolla-tube 3.75-4.5 cm. long, limb 1.5-1.75 cm. wide: petals 3.5 cm. wide, blunt to subacute.

#### Malayan Collections

Perak; Derry 10716, Henderson 10202.

Johore; Corner 32226, s.n. 1.9.35 (Kota Tinggi-Mawai Road).  
 Singapore; Cantley s.n., Ridley 4168 (det. *I. Lobbi*), s.n. 9.11.99 (Chua Chu Kang).

#### Form 2

Corolla-tube, 3.75-4.25 cm. long, limb 1.75-2.1 cm. wide: petals 5-6 cm. wide, subacute.

#### Malayan Collections

Malacca; Goodenough 1907.

#### Form 3

Corolla-tube 3-3.75 cm. long, limb 1-1.25 cm. wide: petals 3.5-4.5 cm. wide, blunt to subacute.

*Malayan Collections*

Penang; Curtis 2975.

Perak; Cantley s.n., Kunstler 675, Wolferston s.n. April 1900, Wray 702.

Pahang; Henderson 24432.

Selangor; Ridley 13409.

Johore; Corner 25968, Ridley s.n. 1900 (Batu Pahat), Singapore F.827.

Singapore; Cantley 2668, 2672, 3005, Goodenough s.n. 1892 (Pulau Ubin) Ridley 5675, 6911, s.n. 1890 (Tg. Penjuru).

*Form 4*

as Form 3 but petals 5-6.5 cm. wide.

*Malayan Collections*

Singapore; Cantley s.n. (det. *I. stricta*).

*Form 5*

Corolla-tube 3-3.75 cm. long, limb 1.5-1.75 cm. wide: petals .35-.5 cm. wide, blunt to subacute.

*Malayan Collections*

Penang; Curtis 667, 1729, 2257 (det. *I. Lobbia* by King & Gamble).

Perak; Curtis s.n. Feb. 1900 (Lumut), Henderson 10203, Ridley s.n. Feb. 1892 (Lumut).

Pahang; Nur 18786.

Selangor; Goodenough 10481, Hume 7162, 7607.

Negri Sembilan; Holtum 9691, 9768, Nur 11570.

Malacca; Alvins s.n., Burkill 788 (det. *I. fulgens*), Derry 8, Goodenough 1692.

Johore; Corner 29766, Kiah 32326, Ridley s.n. 1894 (S. Bau).

Singapore; Hullett 118, Ridley s.n. Reservoir Woods, s.n. Oct. 1889 (Chan Chu Kang).

The flowers are pinkish yellow on opening, turning to light reddish orange. It seems that there may be states with persistently pink flowers.

*Form 6*

as Form 5 but petals .5-.7 cm. wide.

*Malayan Collections*

Penang; Curtis 2265 (see also Form 8).

*Form 7*

as Form 5 but corolla-limb 1.75-2.1 cm. wide, petals subacute.

*Malayan Collections*

Perak; Henderson 10116.

Malacca; Goodenough 1692.

*Form 8*

as Form 5 but corolla-limb 2-2.5 cm. wide, petals .5-.65 cm. wide, blunt to subacute.

*Malayan Collections*

Penang; Curtis 2265 (see also Form 6) (det. *I. fulgens* by King).

Selangor; Hume 7577.

## Form 9

Ixora Singapore

Leaves as in *I. congesta* but rather narrow 4-28 5-9 cm., with 12-18 pairs of lateral veins.

Sepals rather blunt.

Corolla-tube 2.5-3.5 cm. long, the limb 2.3-2.8 cm. wide; petals .5-6 cm. wide, ovate-lanceolate, *acute*, opening pinkish buff with only the base clear orange yellow, turning deep carmine-red or crimson.

## Malayan Collection.

Singapore (cult. in Hort. Bot. Sing.), Corner 30791, 33699, Nur 22, s.n. 26.9.18, Ridley s.n. 1891.

It seems that this *Ixora* was received from Kew many years ago as *I. macrothyrsa*. But the plants in the Singapore Gardens have lost their labels and there is no certainty whence they came. Instead, the name *I. macrothyrsa* has for many years been given to the Common Red *Ixora* of our Gardens which I call *I. javanica* form 7.

Whether *I. congesta* form 9 is *I. macrothyrsa* I have no means of ascertaining. According to description (Bot. Mag. t. 6853) the flowers of *I. macrothyrsa* are persistently red, but the description is not sufficiently critical.

This form 9 has the leaf-shape and size of *I. javanica*, the pointed petals of some forms of *I. javanica* as well as of *I. Lobbiani*, but the numerous veins of *I. congesta*. Its systematic position is problematical yet demonstrative: because of the veins I classify it under *I. congesta*. It corresponds remarkably well with *I. fulgens* as that species must be interpreted from Rumphius' plate and description.

Unlike the common *I. javanica* form 7, this form 9 is strictly seasonal in flowering like the wild plants of *I. congesta*, *I. Lobbiani* and *I. javanica*.

## Form 10

Ixora Kemaman

Leaves with only 9-14 pairs of side-veins.

Corolla-tube 3.25-4 cm. long, the limb 2.5-3.8 cm. wide; petals .5-6.5 cm. wide, oblong, blunt.

## Malayan Collections

Trengganu; Corner 30002 (Kemaman).

Pahang; Symington 28825 (Gunong Tapis), 28761 (Sungei Lembing).

This magnificent *Ixora* with large, brilliant flowers appears to be limited to the watersheds of the Kuantan and Kemaman rivers. It should be classified with *I. javanica multinervia* according to my criterion of the number of veins but the dark brown colour of the dried leaves and their coarse, conspicuous blackish venation is identical with that of *I. congesta* so that I am compelled to regard it as an aberrant form of this species. From the large flowered forms (7, 8) of *I. Lobbiani* it differs in the elliptic, simply pointed leaves (not lanceolate-obovate and acuminate) the fewer, coarser veins and the blunt petals.

## Form 11

Corolla-tube 2.5-3.8 cm. long, limb 2.5-3 cm. wide, petals 6-7.5 cm. wide, blunt to subacute, pale yellow turning light pinkish red.

## Malayan Collections

Singapore; Corner s.n. 25.1.37 (Reservoir Jungle).

I have noticed in Singapore that plants of this form generally flower after those of others forms of *I. congesta* at each seasonal flowering.

*Sterile or Fruiting Specimens* (not flowering)

## Malayan Collections

Trengganu; Moysey 33308.

Perak; Cantley s.n.

Pahang; For. Dept. 15139.

Malacca; Alwins s.n., Goodenough s.n. 1892 (Tebau).

Johore; Holtum 9221, Lake & Kelsall s.n. 20.10.92, (K.

Sembrong) Ridley 11164, s.n. 1900 (Minyak Buku).

Singapore; Cantley s.n., Burkill 709, 714 (det. *I. fulgens*), Hullett s.n. 1893 (Changi Road), Ridley 8410, s.n. 1889 (Selitar), s.n. 9.11.99 (Chua Chu Kang), s.n. 1901 (Yo Chu Kang).

*I. finlaysonian* Don

Siamese White Ixora

Gen. Syst. 3, 1834, p. 572.

A shrub, commonly becoming a small tree 5-6 m. high with stout trunk as thick as a man's leg and massive old branches: glabrous except for the very sparsely puberulous branches of the cyme.

*Leaf-blade* 6-16  $\times$  2-6.5 cm., rather small, lanceolate elliptic to lanceolate obovate or almost spathulate, varying blunt to simply acute, the base very gradually attenuate, rather leathery: *petiole* 4-8 mm. long, short: *stipular point* 1-2.5 mm. long, short.

*Corymb* 6-11 cm. wide, sessile or with a peduncle up to 1.5 cm. long, the branches articulate, pale green, dense, and sparsely puberulous, flowers white, scented: *bracts* 6-12  $\times$  1.5-2.5 mm. linear-lanceolate, pale green: *bracteoles* 2-5  $\times$  5-1 mm. linear: *sepals* 3-5  $\times$  1.5-2 mm., oblong, pointed or rather blunt, glabrous, green-veined, longer than the ovary (1 mm. long): *corolla-tube* 2-3.5 cm. long, glabrous, the mouth also glabrous, pale greenish: *petals* 5-7  $\times$  2.5-3.5 mm., at first acute, becoming blunt with recurved edges, white: ovary often pinkish.

*Distribution*—India, Indo-China, Siam.

*Type*:—Wallich Cat. 6166.

This species is easily recognised from its tree-like habit, its narrow, often blunt, leaves with rather few veins and short petiole (as in *I. javanica*), the white fragrant flowers, linear bracteoles and oblong green-veined sepals exceeding the ovary in length. It is frequently cultivated in India, Indo-China, Siam and Malaya, and its native country appears to be Siam.

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Specimens from the plants cultivated in the Singapore Botanic Gardens were compared recently with the Wallichian type of *I. fulgens* by Mr. M. R. Henderson, who reported that they matched very well. The Malayan plants also agree with Pitard's description of the species except that Pitard describes the leaves as larger, with more pairs of lateral veins (10-12) and the corolla with short tube (19-21 mm. long) and smaller petals (1-5 2-2.5 mm.) (Fl. Gen. Indoch. 3, p. 312). But, as in other *Ixoras*, I find that the flowers vary considerably in size in different collections, the larger-flowered forms being always the more desirable for cultivation.

The species has been received from India for cultivation in Singapore as *I. stricta* var. *alba* which it cannot be because of the long sepals and bracts and the fragrant flowers. I think it has yet to be proved that there is really a white-flowered variety of any red-flowered *Ixora*.

### *I. fulgens* Roxb.

Hort. Beng. 1814, 10. (name and citation of *Flamma silvarum* of Rumph. Herb. Amb. 4, p. 105, t. 16').  
 Typus:—*Flamma silvarum* of Rumphius loc. cit.

#### Interpretations:—

- Roxburgh, Fl. Ind. 1, 1820, p. 387.  
 Wallich, Cat. 6152.  
 Wight, Ic. Pl. I, t. 151.  
 Miquel, Fl. Ind. Bat. 2, 1857, p. 264 (as *Parvella fulgens*)  
 Hooker fil., F.B.I. 3, 1880, p. 146.  
 Koorders and Valetton, Bijdr. Booms. Java 8, 1902, p. 178.  
 King and Gamble, Mat. Fl. Mal. Pen. 4, 1904, p. 79.  
 Merrill, Interpr. Rumph. Herb. Amb. 1917, p. 487: Enum. Phil. Pl. 3, p. 548.  
 Pitard, Fl. Gen. Indoch. 3, 1921, p. 325.  
 Craib, Fl. Siam. Enum. II, 1934, p. 157.  
 Bremekamp, Journ. Bot. 75, 1937, p. 111: Bull. Jard. Bot. Buit. ser. 3, 14, 1937, p. 215.

From Roxburgh's description in the Flora Indica it is clear the binomial *I. fulgens* was made for a plant cultivated in the Royal Botanic Gardens at Calcutta, the plant having been introduced from the Moluccas. There is no specimen of Roxburgh's plant but a drawing of his which is that reproduced by Wight. There is also a collection of Wallich's 6152 which Wallich, who was Roxburgh's successor, identified with *I. fulgens*, and which was evidently seen and passed as such by Wight. Therefore, though Roxburgh's plant may have disappeared, it should be possible to determine what Roxburgh intended for *I. fulgens* from his drawing and from Wallich's specimens. Unfortunately, according to the Rules of Botanical Nomenclature, neither of these clues indicate what, taxonomically, must be intended by *I. fulgens*. The first publication of this binomial is in

Roxburgh's *Hortus Bengalensis*. This is accepted as a valid publication and, because a species can be validated merely by citation of a plate, Roxburgh's binomial *I. fulgens* which is without description is validated by reference to Rumphius' plate. Hence, taxonomically, the identity of *I. fulgens* hangs upon the identification of Rumphius' *Flamma silvarum*, about which no more is known than what Rumphius has written. Nevertheless, several interpretations have been made which I will now elaborate.

Roxburgh's own interpretation by his description and drawing, reproduced by Wight, is the first. It has been denied recently by Merrill and Bremekamp, after a century's acceptance, though I cannot discover that it has ever been amplified or critically examined in the light of modern systematics. Wallich's interpretation, by his collection 6152, has never been published, there being no description of his specimen: I imagine that his interpretation must coincide with Roxburgh's. Hooker's interpretation combines that of Roxburgh's and Wallich's (by quotation), with *I. Lobbii* by citation and by specimens (according to King and Gamble): it seems that the *Ixoras* which botanists now call *I. Lobbii*, Hooker called *I. fulgens*. Koorders and Valeton follow Hooker and make *Parveta salicifolia* Bl. into a variety of *I. fulgens* in their sense (=*I. Lobbii*). King and Gamble deny Hooker's interpretation and, distinguishing *I. Lobbii* from *I. fulgens*, refer to *I. fulgens* a narrow-leaved *Ixora* which appears to be my *I. javanica retimervia* (at least, according to the collections Wray 3021 and Scortechini, cited by King and Gamble, and according to their description). Merrill (1918) arrived at no decision concerning the identity of *I. fulgens*, though he named as such the Amboina collection, Robinson 169: there is no description of the collection so that Merrill's interpretation is hid, like Wallich's, until the specimens be examined and described. Later, 1923, Merrill identified, without advancing reason, *I. congesta* Roxb. with *I. fulgens* Roxb., thus refuting Roxburgh's own interpretation: (the acute petals shown in Rumphius' plate ill suit the blunt ones of *I. congesta* described by Roxburgh). Pitard's interpretation is a copy of that of King and Gamble ("teste the misquotation of Wight's plate). Craib also follows King and Gamble and identifies a Siamese collection with *I. fulgens*. Most recently Bremekamp has given the problem a wholly new turn by remarking that "Roxburgh described this species [*I. fulgens*] from a plant cultivated in the Botanic Gardens, Calcutta. It was supposed to have been introduced from the Moluccas, but this was obviously a mistake, probably due to a superficial resemblance to the plant described and figured by Rumphius under the name

*Flamma silvarum*". Further, Bremekamp adds for the distribution of *I. fulgens* "Known with certainty from Tenasserim only"; and he seems to doubt Craib's identification of the Siamese plant. As regards Bremekamp's first point, if it is true, then he has discovered some information hitherto unknown to botanists, even to Roxburgh himself, which will give a different value to Roxburgh's interpretation, yet one cannot except such a bare contradiction without proof. But from Bremekamp's second point, it is clear that he has misunderstood the taxonomic intricacy of the identity of *I. fulgens* which can be determined, if at all, only from the Amboina-flora. Moreover, like that of Merrill and Wallich, his interpretation of *I. fulgens* must remain a mystery to botanists who cannot examine the specimens cited, because there is no description. (Such interpretations seem to me valueless and of the same category as *nomina nuda*: the essence of systematic botany being to classify plants with sufficient accuracy that other botanists may recognise them from the *published descriptions*, hence *nomina nuda* are illegal, and so, too, should be *interpretationes nudi*: the mere citation of specimens or expression of opinion should be as insufficient to validate the interpretation).

It must be remarked, now, that from King and Gamble onwards there has passed unnoticed a discrepancy between the description of *I. fulgens* given by King and Gamble and the descriptions of Roxburgh and Rumphius. King and Gamble give the leaves of *I. fulgens* as  $3\frac{1}{2}$ – $5\frac{1}{2} \times 1\frac{1}{4}$ – $1\frac{1}{2}$ " : Rumphius gives  $8$ – $12 \times 2$ – $3\frac{1}{2}$ ", for *Flamma silvarum*: and Roxburgh gives  $6$ – $8 \times 1$ – $3$ ". I think that it is extremely improbable that *I. fulgens sensu* King and Gamble, with such small narrow leaves, should be identical with *Flamma silvarum* of Rumphius. Hence, it is evident that the interpretation of *I. fulgens* by King and Gamble and also those by Pitard, Craib and Bremekamp, who cite King and Gamble are doubtful. Bremekamp's interpretation is rendered yet more uncertain because he has not followed up the clue to Roxburgh's interpretation which the Wallichian specimens must afford.

*I. fulgens* Roxb. has therefore been interpreted as *I. Lobbii*, *I. congesta* and *I. javanica*, the three common species of Western Malaysia, from which I conclude that it is still an unknown species awaiting identification by a resident of Amboina. However, I may give my own interpretation which is that my *I. javanica* form 7 is the Rumphian plant, for the following reasons.

There is no record how this form 7 which is the Common Red *Ixora* of Malayan gardens, was introduced to

Malaya but it has evidently been in cultivation for very many years. It agrees so well with Roxburgh's description and drawing as well as with Rumphius' that I can find no discrepancy: it also has large leaves, 1-11  $1\frac{1}{2}$ -4  $\frac{1}{2}$ " and, as Roxburgh remarks, it blossoms most part of the year. Wallich's collection 6152a came from Penang and on Singapore; it agrees presumably with Roxburgh's drawing; it may even have been our Common Red *Ixora* because there is no other common big-leaved *Ixora* with red, pointed petals in Penang or Singapore. Now, if Roxburgh's plant of *I. fulgens* came from the Moluccas, is it not likely that this same species was brought by the early travellers to other countries and to what place more likely than Penang, especially on its way to India? Rumphius called his other red *Ixora*, *Flammaria silvarum peregrina*, for the very reason that it had been widely dispersed and cultivated by travellers so early as the seventeenth century. If this be so, then we shall have the explanation of the origin of our common garden plant and it will be necessary to reduce *I. javanica* to *I. fulgens*.

*Some Collections determined as I. fulgens*

Merrill 1362 (Palawan) is *I. Lobbu* var. *stenophylla* form 10.

Moulton 78 (Borneo) is *I. Lobbu* form 8.

Ridley 8970 (Sumatra) is *I. Lobbu* form 5.

Wray 3024 (Perak) is *I. javanica* var. *retinervia*.

## ***I. grandifolia* Zoll. et Mor.**

Pink River *Ixora*.

Syst. Verz. 1846, p. 65 (= *Pavetta macrophylla* Bl.).

Synonyms:—

*Pavetta odorata* Bl., Bijdr. 1825, p. 952 (haud *I. odorata* Spreng., Syst. Veg. I. 1825, p. 407).

*Pavetta macrophylla* Bl., Bijdr., 1825, p. 953 (haud *I. macrophylla* DC. Prodr. 4, 1830, p. 487).

*Ixora Blumei* Zoll. et Mor., Syst. Verz. 1846, p. 65. (= *P. odorata* Bl.).

? *Pavetta Teysmanniana* Miqu., Fl. Ind. Bat. 2, 1854, p. 267 (fide Hooker fil., F.B.I. p. 143).

? *Pavetta macrocoma* Miqu., loc. cit. p. 274 (fide Hook. fil., loc. cit.).

? *Ixora arborescens* Hassk., Retzia I, 1858 p. (? 22) (fide Hook. fil., loc. cit., et Koorders et Valetton, Bijdr. Booms. 8, p. 150).

*Ixora macrosiphon* Kurz., Journ. Bot. I, 1875, p. 327 (fide Hook. fil., loc. cit.).

*Ixora rosella* Kurz., For. Fl. Burma II, 187, p. 23 (fide Hook. fil., loc. cit.).

*Ixora odorata* (Bl.) K. et V., Bijdr. Booms. Java, No. 8. 1902, p. 165.

*Ixora coriacea* Ridley, Journ. St. Br. R. As. Soc. 79, 1914, p. 83: Fl. Mal. Pen. II, 1923, p. 98. (= *I. elliptica* Ridley).

*Ixora crassifolia* Ridley, loc. cit. p. 83: Fl. Mal. Pen. II, p. 98. (haud *I. crassifolia* Merrill, 1910).

*Ixora fluminalis* Ridley, loc. cit. p. 84: Fl. Mal. Pen. II.

p. 97.

*Ixora gigantea* Ridley, loc. cit. p. 81.*Ixora elliptica* Ridley, Fl. Mal. Pen. II, 1923, p. 98.*Ixora Ridleyi* Merrill, Gard. Bull. 8, 1935, p. 132.*Ixora lancifolia* Ridley, Journ. Bot. 72, 1934, p. 256.*Ixora Valetonii* Hochr., Candollea 5, 1934, p. 261.*Varieties*var. *coriacea* Hook. fil., F.B.I., III, 1880, p. 143.var. *arborescens* Hook. fil., loc. cit.var. *Kurziana* Hook. fil., loc. cit.var. *rosula* Hook. fil., loc. cit.var. *gigantea* King and Gamble, Mat. Fl. Mal. Pen. 4, 1907, p. 156.var. *acutifolia* Hochr., Candollea 5, 1934, p. 257.var. *lancifolia* var. nov.

A shrub or tree up to 20 m. high, often flowering as a spindly bush 1½–5 m. high: *twigs pale, greyish white or silvery buff*: glabrous except the puberulous panicle and often puberulous style.

Leaf-blade 10–32 × 1–18 cm., *rather large to very large, elliptic, often inclined to ovate*, the apex blunt or acute, the base cuneate, rounded or even cordate, *more or less coriaceous*; primary lateral veins 6–16 pairs, directed obliquely forward, *anarching near the edge*, with coarse faint reticulations, *the venation generally visible on both sides of the dried leaf*: petiole .6–3.5 cm. long, stout: stipules 5–12 mm. long, broadly triangular with a minute point, generally more or less sheathing.

Corymb 12–23 cm. wide, erect, *sessile*, with 3 main, long-stalked branches from the base, the peduncles of the branches generally 5–9 cm. long, *the branchlets not articulate*, green flushed reddish, the corymb falling entire: *flowers crowded, some sessile, others shortly stalked, fragrant or not*: sepals shorter than the ovary, blunt to subacute: corolla-tube .6–3 cm. long, *pink or reddish*: petals 4–5.5 mm. long, 1.5–2.5 mm. wide, oblong, blunt or subacute, *reflexed along the tube*, not spreading, *white*, often tipped pink: anthers yellow: style projecting 3–5 mm. *glabrous on the part in the corolla-tube, more or less hairy*, white.

Berries 10–12 mm. wide, subglobose, distinctly longitudinally sulcate when dried, green turning red then black.

Distribution:—Burma, Indo-China, Andaman and Nicobar Islands, Malaya, Sumatra, Java, Borneo, Philippines, ? Celebes.

var. *lancifolia* var. nov.

Marsh Ixora

Frutex vel arbor minor, vix ramosus, usque 5 m. altus.

Lamina 20–36 × 3.5–12 cm., *lanceolata*, linearis (30–3.5 cm.) vel lanceolato-obovata, obtusa vel subacuta, *utrinque gradatim attenuata praecipue basim versus, carnosus-subcoriaceus, subtus siccis minute papilloso—rugulosa, nervis reticulatis haud distinctis, costis lateralibus utrinsecus* 10–14.

Corymbus 8–16 cm. latus, *semper minor*, ramis 3 brevioribus pedunculo 1.5–5 cm. praeditis: corollae tuba 12–16 mm. vel 17–20 mm. longa.

Distribution:—Malaya, Sumatra.

Typus:—Ridley 2213 (Tahan River, Pahang).

That *I. grandifolia* is a variable species can be judged from the list of synonyms, as well as from the number of forms which I have distinguished. As it grows in Malaya, the species could be split into six or seven according to the inadequacy of the herbarium material, for one sheet typical of each form might be considered a species. However, from the numerous collections in the Singapore Herbarium and from the numerous plants which I have studied in the forest, I have discovered that these forms are by no means clearly defined and that with our present knowledge the subdivision of *I. grandifolia* is impossible. Indeed, in the wide sense, it is easily and conveniently recognised as a common species of swampy forest in Western Malaysia. In this sense, the species was understood by Hooker, King and Gamble; and so too by Koorders and Valeton, except for their separation of *I. odorata* (Bl.). Recently, for reasons which appear to me wholly inadequate as well as conflicting, Ridley has divided the species into six. As in the red-flowered *Ixoras*, the variability of *I. grandifolia* is not yet appreciated.

For the legitimate name of the species in this wide sense I have adopted *I. grandifolia*. The alternative, simultaneous name *I. Blumei* I have made the synonym because it is not well-known while the first is. Both these names of Zollinger and Moritz were proposed for Blume's two species without any reason being given, though evidently because Blume's specific names would make later homonyms in the genus *Ixora*—a point overlooked by Koorders and Valeton in their *I. odorata* (Bl.). For the interpretation of the species of Blume, Miquel, Hasskarl and Kurz, I have followed Hooker, Koorders, Valeton, King and Gamble, having no access to the types. Ridley's species I have been able to examine personally in Singapore.

As regards *I. grandifolia*, in the wide sense, the variability of the leaves in shape and venation has not been properly explained and it seems that the variability in the length of the corolla-tube, in the fragrance of the flowers and in the hairiness of the style is not realised at all: there is confusion also about the colour of the flower. That some trees have pointed and others blunt leaves I am certain from the numerous trees of my form 3 which I have studied in the East of Johore, but some collections are intermediate. The number of veins is also a fairly constant distinction but also imperfect through the occurrence of specimens with 9–12 pairs of lateral veins: unfortunately, because of the large size of the inflorescence, herbarium-specimens generally have only one or two pairs of leaves on the twig below the panicle and these uppermost leaves of the twigs

are commonly reduced. As for the leaf-base it varies greatly: even on the same plant, I have seen leaves with gradually tapered, cuneate, rounded and cordate bases, so that one unacquainted with the living trees might well make four species from separate leaves of the same plant. Concerning the texture of the leaf, I think there is great variability which cannot be used satisfactorily in defining varieties because of the numerous intergrades, with the one exception of var. *lanceifolia* in which the texture is accompanied by other peculiarities. That the length of the corolla-tube is no sign of specificity is obvious from the fact that there are specimens differing only in this one character. And, likewise, regarding the hairiness of the style which I find to be as often rather sparsely puberulous as glabrous (this point cannot be determined without pulling the style from the flower because it is the part of the style in the corolla-tube which is hairy). The colour of the flower may be described generally as white or pink, according as the corolla is open or not. When the flowers of a corymb are not yet open they look pink because the reddish pink corolla-tubes are conspicuous: but when the flowers open, the white petals are reflexed, concealing the corolla-tubes almost completely. Thus, I believe, have arisen the 'conflicting' statements of the flowers as white or pink, just as with *I. pendula*. The flowers are generally very fragrant but I have seen several trees in Johore (my form 3, as 32277) which had scentless flowers. I think this as important a varietal character as any other in the species, though it is one that will not commend itself so long as we are limited to dried specimens.

As regards *I. odorata* (Bl.) K. et V., the authors of the combination say that from *I. grandifolia* it is "toto coelo diversa (N.B. fructus valde diversi)". Nevertheless I am unable to follow them. The fruit of *I. grandifolia* they describe as 6-12 mm. wide and distinctly divided in 2 lobes, or didymous: that of *I. odorata* they describe as only 6-7 mm. wide and long, globose and never didymous, although in their plate (Bauniart. v. Java, fig. 551) a slightly didymous fruit is shown. I find that the normal 2-seeded ripe fruits of *I. grandifolia* are 10-12 mm. wide and, when dried, are distinctly didymous as is general in *Ixora*, but that immature fruits 1-8 mm. wide, even when dried, do not show a longitudinal sulcation between the two seeds. Hence I conclude that Koorders and Valetton drew their opinion from immature fruits. But these authors also distinguish *I. odorata* by its short corolla-tube and hairy style. But as I have said, these characters vary much in different collections of *I. grandifolia* which in other respects are

identical. It seems a little fastidious, moreover, to distinguish two species of tree solely on the hairiness of the filiform style. *I. odorata* (Bl.) K. et V. is my *I. grandifolia* form 1: and *I. grandifolia* sensu K. et V. consists of my form 5 and my form 2 (as shown by the figure, Baumart. v. Java. fig. 515, in which the leaves are drawn with few lateral veins).

Hooker's varieties, as amplified by King for the Malayan flora, I interpret in this way. The var. *gigantea* is based on the size, shape and texture of the leaf and so it covers my form 2 (Ridley 1120), form 3 (Curtis 3384), form 4 (Wray 2973, 3971) and form 5 (King's coll. 5609, 10294, Wray 3678). The var. *coriacea*, based on the more or less lanceolate, very coriaceous leaf, covers my form 5 (Curtis 2186, Wray 2110) and, perhaps, var. *lanceifolia* (Ridley 2213, which King doubtfully referred to var. *coriacea*). The var. *arborescens* covers my form 1 (Derry 310) and form 2 (Derry 571, King's Coll. 1686, Ridley 4165). The var. *rosella* may be my form 3, on account of its pointed leaves, but Kurz describes the corolla-tube "about an inch long", though Hooker gives  $\frac{1}{2}$  -  $\frac{3}{4}$ ". It seems to me that the varieties *gigantea*, *coriacea* and *arborescens* are unsatisfactory because from their definitions so many variable features have been omitted though it may be possible to define accurately var. *arborescens* and var. *coriacea* from the single, and therefore the type, specimens cited for each by Hooker.

As regards *I. macrosiphon* Kurz (— *I. grandifolia* var. *Kurzeana* Hook. fil), it differs from *I. grandifolia* only in the longer corolla-tube (2.5–3 cm. long) and my form 6 connects the two, having the tube 1.7–2 cm. long. The three collections of *I. macrosiphon* in the Singapore Herbarium leave no doubt that it is conspecific. These collections, which are cited by King and Gamble as var. *Kurzeana* are:—King's Collector 277, s.n. 3.3.94, Prain's Collector s.n. 1899 (all from the Andamans). The variety has not been found in Malaya, though it probably occurs.

Ridley's species are hard to understand through the different treatment which he has given them in his Flora and his previous paper. Thus *I. coriacea* of his paper (1918), based on Wallich 6151 which is the type of *I. grandifolia* var. *coriacea* Hook., is assigned to both *I. crassifolia* and *I. elliptica* in his Flora, while *I. gigantea* of his paper (starting in the middle of line 8 from the top of p. 81) which is there said not to be true *I. grandifolia* of Zollinger, is omitted from the Flora, though under *I. grandifolia* of the Flora it is remarked that var. *gigantea* King and Gamble "is a typical form" of the species.

*I. coriacea* Ridley, based on Wallich 6151, is evidently my form 5, according to Ridley's description, and this agrees with King's interpretation of var. *coriacea* Hook. (also based on Wallich 6151). In his paper, Ridley doubtfully refers Wallich 6153 to *I. coriacea*, but in his Flora he refers both Wallichian collections to *I. elliptica*. As the specific names "coriacea" and "elliptica" are manuscript names of R. Brown taken up by Ridley, it follows that *I. elliptica* ex Ridley is an exact synonym of *I. coriacea* ex Ridley. I may add that both Hooker and King regarded Wallich 6153 as typical *I. grandifolia*.

*I. crassifolia* is based firstly, in the paper (1918), on a specimen of Griffith's from Ayer Panas in Malacca and to it, in the Flora, Ridley assigns many other specimens as well as var. *coriacea* Hook. It is possible that this collection of Griffith's should be taken as the basis of var. *arborescens* Hook., but Griffith's specimens are not available in Malaya. In any case, Griffith's specimen is the type of *I. crassifolia* and, from Ridley's original description, I find it hard to distinguish from *I. coriacea*: it is said to have a blade  $3-9 \times 3-3\frac{1}{2}$ " with a blunt base. *I. crassifolia* of Ridley's Flora is said to have a blade  $13 \times 3$ ", lanceolate and narrowed to both ends, as my var. *lanceifolia*, and the cited collections, which I can check for certain in Singapore, namely G. Janeng (Kelsall), Tahan River and Pekan, are my var. *lanceifolia* to which Griffith's specimen from Ayer Panas cannot belong if Ridley has correctly described it. Hence, I have no hesitation in making the new variety *lanceifolia*, for it is not covered by the original definition of any of Ridley's species or of Hooker's and King's varieties.

*I. Ridleyi* Merrill was proposed for *I. crassifolia* Ridley, which is a later homonym of *I. crassifolia* Merrill. Merrill merely cited Ridley's references so that he threw but another cloud over the problem.

*I. fluminalis*, as originally described, covers my form 1 (Derry, s. Rumbai), form 2 (Ridley 4165; Kunstler, Goping) and form 5 (Haniff 1019). It represents the common forms of *I. grandifolia* with leathery blunt leaves. A distinction of seeming importance between *I. fluminalis* and *I. grandifolia* which must occur to the reader studying Ridley's description is that *I. grandifolia* is said to have white flowers and *I. fluminalis* yellow. The corollas of both, however, have the white limb and pink tube typical of *I. grandifolia*. The reason for ascribing yellow flowers to *I. fluminalis* seems to have been the field-note of Kunstler's collection 4686, the "yellow flowers" of which refer, however, to the tiny calyces from which the corollas have

dropped. The distinction in flower-colour, of white or pink, given by Ridley for his species depends on whether the flowers of the specimen were open in which case they would have looked white, the reflexed limb concealing the corolla-tube, or not open, the pink tube then being more striking. It seems, in any case, that *I. fluminalis* must be discarded. Ridley based his species on "*I. grandifolia* var. *arborescens* King not *I. arborescens* Hassk." By this, Ridley meant var. *arborescens* Hook. fil in the definition of which Hasskarl's *I. arborescens* was directly cited. In other words, taxonomically, *I. fluminalis* Ridley is *I. grandifolia* var. *arborescens* Hook. fil. which is *I. arborescens* Hassk. with Hasskarl's plant as the type of each.

A specimen of Haviland's collection 2157, which is the type of *I. lancifolia* Ridley, in the Singapore Herbarium shows this species to be identical with the small-flowered, few-veined *I. Blumei* which is my *I. grandifolia* form 1.

*I. timoriensis* is very close to *I. grandifolia* but it differs in the laxer inflorescence with fewer flowers, all of which are distinctly pedicellate, and in the hairy corolla-mouth. I should be inclined to consider it as a variety, in which case it would be the legitimate name for the species.

#### KEY TO THE FORMS AND VARIETY OF *I. GRANDIFOLIA*

Leaves lanceolate, very gradually tapered to the base,  
the reticulations invisible in the dried leaf, and  
the undersurface finely wrinkled ... .. var. *lancifolia*  
Leaves more or less elliptic: reticulations visible:  
undersurface even

Leaves with 6-10 pairs of side-veins: blade up to  
9 cm. wide

Corolla-tube .6-9 cm. long . . . . . Form 1

Corolla-tube 1-1.2 cm. long . . . . . Form 2

Leaf-blade blunt . . . . . Form 2

Leaf-blade acute . . . . . Form 3

Leaves with 10-16 pairs of side-veins: blade  
7-18 cm. wide

Corolla-tube .7-1.0 cm. long . . . . . Form 4

Corolla-tube 1-1.2 cm. long . . . . . Form 5

Corolla-tube 1.7-2.0 cm. long . . . . . Form 6

Corolla-tube 2.5-3 cm. long . . . . . (var. *Kurssiana*)

#### Form 1

Leaves with 6-10 pairs of lateral veins, acute, subacute or  
blunt, 3.5-9 cm. wide.

Corolla-tube short 6-9 mm. long.

#### Malaya

Pahang; Cons. For. 3603.

Negri Sembilan; Alvins s.n. (S. Ujong).

Malacca; Alvins 2254, 2332, Derry 310 (det. *I. grandifolia*  
var. *arborescens* by King).

#### Bornean Collections

Carr 26520, For. Dept. B.N.B. 4721, Wood 2033.

Haviland 1673 (det. *I. fluminalis*), Omar 395 (det. *I. fluminalis*).

Haviland 2157 (det. *I. lancifolia*).

*Javan Collections*

v. Steenis 2415 (det. *I. odorata* and *I. Blumei*).

Two forms might be made of this one, as in Forms 2 and 3, according as the leaves are blunt or acute. But my object is merely to explain the variety.

*Form 2*

Exactly as *Form 1*, but the leaves blunt

*Malayan Collections*

Perak; King's Collector 4686 (det. *I. grandifolia* var. *arborescens* by King).

Pahang; For. Dept. 15659, Burn Murdoch 200 (no flowers, det. *I. concinna*).

Malacca; Derry 571.

Johore; Corner 25892, 28628, s.n. 3434 (S. Kambau pr. S. Sedili), Ridley 1165 (det. *I. grandifolia* var. *arborescens* by King), 13490, 15387.

Singapore; Ridley 4120 (det. *I. grandifolia* var. *gigantea* by King).

*Sumatran Collections*

Boden-Kloss 14567 (Siberut: det. *I. coriacea*).

*Javan Collections*

Koorders 34368, Teysmann 18651 (det. *I. macrophyllodes* and *I. fluminalis*).

(Koorders et Valetton, Baunart. v. Java fig. 515).

*Form 3*

Leaves 3.5-9 cm. wide, the apex acute and generally acuminate with a tip 6-12 mm. long: lateral veins 6-10 pairs, the reticulations often very faint.

Corolla-tube 1-1.2 cm. long, the petals 3-4.5 × 1.5-2 mm. blunt.

*Malayan Collections*

Kedah; For. Dept. 17890.

Penang; Curtis 3384 (det. as *I. grandifolia* var. *gigantea* by King).

Malacca; Alvins 797.

Johore; Corner 32052, 32277, 32498, s.n. 11436 (S. Kayu, pr. S. Sedili).

*Sumatran Collections*

Boden-Kloss 14669 (Sipora II.), Krukoff 4088, 4207, 4328.

*Bornean Collections*

J. & M. S. Clemens 26255, 31294.

*Form 4*

As *Form 3* but the corolla-tube 7-10 mm. long.

*Malayan Collections*

Perak; Wray 2973, 3971 (both det. *I. grandifolia* var. *gigantea* by King).

*Sumatran Collections*

Bartlett 2887.

*Javan Collections*

s.n. cult. Hort. Bog. XIII (det. *I. odorata*).

*Form 5*

Leaf-blade 7-18 cm. wide, blunt, with 10-16 pairs of side-veins: petiole 1.5-3.5 cm. long.

Corolla-tube 1-1.2 cm. long.

*Siamese Collections*

Haniff and Nur 4049 (det. *I. fluminalis* Ridley by Craib).

*Malayan Collections*

Kedah; Haniff 15180 (det. *I. fluminalis* Ridley by Craib), 21020.  
 Penang; Curtis 2186 (det. *I. grandifolia* var. *coriacea* by King).  
 Perak; King's Collector 5609, 10294 (both det. *I. grandifolia*  
 var. *gigantea* by King), Wray 2140 (det. *I. grandifolia*  
 var. *coriacea*), 3678 (det. *I. grandifolia* var. *gigantea* by  
 King).

Pahang; For. Dept. 17133.

Negri Sembilan; Alvins 1177.

Johore; Corner 28.78, s.n. 11.10.36 (S. Kayu, pr. S. Sedili),

Henderson 28419, Kiah s.n. 6.10.36 (S. Kayu, pr. S. Sedili),

Lake and Kelsall s.n. 22.10.92 (G. Janing).

*Sumatran Collections*

Krukoff 4397.

*Bornean Collections*

For. Dept. B.N.B. 4302 (Brunei), Wood 2121.

*Form 6*

As form 5 but the corymb smaller and denser, 10–13 cm.  
 wide, with the peduncles of the main branches 2.5–4 cm. long;  
*corolla tube longer*, 1.7–2 cm., the petals 5 cm. long, blunt to  
 subacute.

*Malayan Collections*

Johore; Kiah s.n. 6.10.36 (S. Kayu, pr. S. Sedili).

The length of the corolla-tube in this form bridges the  
 gap between *I. grandifolia* and var. *Kurziana* (*I.*  
*macrosiphon* Kurz) in which it is 2.5–3 cm. long.

**var. lancifolia** Corner*Malayan Collections*

Kelantan; Nur and Foxworthy 11953.

Trengganu; (Kemaman), Corner 30719, s.n. 13.11.35 (2 sheets).

Pahang; Burkill s.n. June 1915 (Pulau Tioman), Ridley 2213,

(det. *I. grandifolia* var. *coriacea* by King), s.n. 1891

(Pengkalan Kasai), s.n. 1893 (Taka Tahan).

Negri Sembilan; Burkill 4478.

Malacca; Alvins s.n. (5 sheets), 2081, 2153, 2224, Derry 67.

Johore; Corner s.n. 9.3.36, s.n. 10.4.36 (Ulu Segun, Gunong

Panti), Holtum 9282, Kiah s.n. 12.10.36, s.n. 6.3.37. Lake

and Kelsall s.n. 21.10.92 (G. Janing), Nur 19988, Ridley

s.n. Jan. 1910 (Panti River, Kota Tinggi).

*Sumatran Collections*

Bartlett 7479 (pr. Loemban River, Asahan).

Forbes 1986 (det. *I. grandifolia* var. *coriacea* by King).

**COLLECTIONS INTERMEDIATE BETWEEN *I. GRANDIFOLIA*  
 AND VAR. *LANCIFOLIA***

Kelantan; Haniff and Nur 10090.

Perak; Derry s.n. 1899 (Maxwell Hill, det. *Tarennia grandi-*

*folia*), King's Collector 5935 (det. *I. grandifolia* var.

*coriacea* by King).

Pahang; Henderson 22416 (det. *I. crassifolia*), For. Dept.  
 41042.

Selangor; For. Dept. 16904 (det. *I. crassifolia*).

**I. javanica (Bl.) DC**Javanese *Ixora*

emend. Koorders et Valetton, Bijdr. Booms. Java 8, 1902, p. 160.

Basynym:—*Parrotia javanica* Bl., Bijdr. 1826 p. 949.

Synonyms:—

*Ixora stricta* auctt. non. Roxb.*I. fulgens* auctt. non. Roxb.*I. amoen* Don, Gen. Syst. 3, 1817, p. 571.*I. stricta* var. *amoen* Ridley, Fl. Mal. Pen. 2, 1923, p. 94*I. anorosa* Ridley, Journ. Bot. 72, 1934, p. 251.

Icones:—

Bot. Mag. t. 4586.

Baumart. Java 1, t. 553.

An evergreen shrub or small tree to 8 m. high, the trunk 1-8 cm. thick, with smooth brown bark: glabrous.

*Leaf-blade* 5-25.5 × 1.8-11.5 cm., elliptic, varying narrowly elliptic to lanceolate in riverside forms, *simply acute* or at most subacuminate, the base *varying from gradually tapered and narrowly cuneate to rather suddenly rounded*, widest about the middle, the proximal half often wider than the distal, membranous to subcoriaceous or distinctly coriaceous in some cultivated forms, *rather dull green*, often light or yellowish green: *lateral veins* 6-14 pairs, generally 6-10 or 9-13, inclined obliquely forward and without distinct marginal loops or in var. *retinervia* distinctly inarching: *petiole* .25-1.5 cm. long: *stipular point* .1-7.5 cm. long, longest in the narrow-leaved riverside forms.

*Corymbs* 3.5-20 cm. wide, with peduncles 0-9 cm. long, the branches *articulate and coral-red*: sepals blunt to subacute, variable in the same flower: *corolla-tube* 2-5 cm. long, the limb 1-3.8 cm. wide, the petals *varying blunt to acute*.

Berries 1.2-2 cm. wide, depressed globose, ripening red then black, 1-2 seeded.

Distribution:—India, China, Siam, Malay Archipelago.

**var. multinervia var. nov.**

*costis lateralibus utrinsecus* 9-14, *marginem versus non arcuato-connexis*: lamina usque 25.5 × 11.5 cm., non vel vix acuminata.

Typus:—Corner 33438 (Kota Bahru, Kelantan, 22.4.37).

**var. paucinervia var. nov.**

*costis lateralibus utrinsecus* 6-9 (-10), *marginem versus non arcuato-connexis*: lamina usque 15.5 × 7.8 cm., non acuminata.

Typus:—Burkill and Haniff 17312 (Telok Sisek, Pahang, 4.12.24).

**var. retinervia var. nov.***Ixora* Lotong

*costis lateralibus utrinsecus* 7-12, *marginem versus conspicue arcuato-connexis*, costa media angulo lato excurrentibus: lamina 6-15.5 × 1.7-5.8 cm., elliptica vel oblongo-elliptica, *plus minus acuminata*.

Typus:—Corner 29020 (E. Johore, 9.2.35).

**KEY TO THE VARIETIES**

*Lateral veins* of leaf making a wide angle with the midrib, *conspicuously inarching with wide loops near the margin*: leaf-blade *generally more or less acuminate*, up to 15 × 5.5 cm. ..

var. *retinervia*

Lateral veins of leaf inclined obliquely forward,  
not distinctly inarching: leaf-blade not acuminate

Lateral veins 6-9 (10) pairs, blade up to  
15-55 cm.

var. *paucinervis*

Lateral veins 9-11 pairs: blade up to 25  
11 cm.

var. *multinervis*

There is much confusion over the nomenclature of the Malayan plants which I refer to *I. javanica*. They have been called *I. stricta* Roxb. until recently when Ridley has made them a new species, *I. aurea*, and Burkill has referred them to *I. chinensis* Lam. (Dict. Econ. Prod. Mal. Pen. 1935). But, as I have explained under *I. chinensis*, *I. stricta* Roxb. is to be interpreted as a synonym of *I. chinensis*, which differs from the Malay specimens in its very short petiole and very blunt petals so that, provided this distinction is held, the Malayan specimens are not *I. chinensis*. I find that they agree exactly in all essentials with *I. javanica* as interpreted by Koorders and Valetton for the Javanese flora. Craib identified them with *I. amoena* but, as I have shown under that species, I can find no difference between it and *I. javanica*. Ridley's latest interpretation I consider no solution because it deals with very few specimens and, while resting on such extremely variable features as the size of leaf, stipule, corymb and corolla and the shape of sepals and size of corolla-tube, it ignores differences in the venation, the shape and size of the petals, and the colour of the flowers, and omits the common Red *Ixora* of Malayan gardens and villages.

*I. javanica* is the commonest and most variable *Ixora* in Malaya. I have distinguished 3 varieties and 30 forms so that the variation may be perceived. The one which I have found to be most constant is var. *retinervia*, which has not been recognised previously, yet there are intermediates between them all. Until the species has been studied genetically, I do not see how it can be dissected profitably in the herbarium.

*I. pseudojavanica* Bremekamp, *I. ovalifolia* Bremekamp and *I. lacuum* Bremekamp (Journ. Bot. 75, 1937, pp. 170-171) are to me only forms of *I. javanica*. Such "splitting" is quite impracticable.

var. *retinervia* var. nov.

*Ixora* Lotong

The Malayan specimens are remarkably constant in having rather small, subacuminate glossy leaves, drying dark-brown, fuscous or even black, inarching veins often making almost a right angle with the midrib, small corymbs 4-9 cm. wide and small corollas (tube 3-4 cm. long; limb 1-1.6 cm. wide; petals .25-.3 cm. wide, oblong or subelliptic, more or less acute, light orange-yellow turning scarlet or

deep red.). One might, therefore, regard the variety as a species but there are several collections intermediate with var. *paucinervia* and as these lack the full characteristics of var. *retinervia* I have classed them with var. *paucinervia*. The variety *retinervia* also resembles *I. Lobbii* var. *stenophylla* in the Herbarium: the distinctions are given under *I. Lobbii*. Compare also *I. concinna*.

It appears that there are forms of this variety in Borneo which have not only larger flowers but leaves which dry pale. The systematic position of these Bornean specimens, which I have listed below, is problematical because they resemble also *I. Robinsonii*. Many more collections will be needed to establish their status from their variability.

#### Malayan Collections

Penang; Curtis 1112 (det. *I. stricta* by King), s.n. B. Lakshmana March 1890, (det. *I. stricta* var. *amoena* by King): For. Guard. 1112.

Perak; Wray 3024 (det. *I. fulgens* by King).

Pahang; Burkill 15704, 17229; Henderson 22009; Ridley 2226, 2227, 16243 (det. *I. concinna*); Strugnell 23453.

Trengganu; Moysey 33643.

Selangor; Burkill 6842.

Nagri Sembilan; Holttum 9609; Kloss s.n. B. Tangga 1910; Nur 11669; Ridley s.n. G. Angsi, Feb. 1900.

Malacca; Alvin 62, 567, s.n. 29.1.86; Derry 257; Goodenough 1753, 1826.

Johore; Best 7717; Corner 29020, 29939; Goodenough s.n. 1893; Ridley 10940 (? 16940), s.n. 1892, s.n. 1898, s.n. 1906 (? 1908).

Singapore; J.S.G. 3999, 5004; Ridley s.n. 1904.

#### Bornean Collections

? Winter 2154 (S.E. Borneo, 1908), det. *I. amoena*: (the inarching of the veins not always distinct): (det. *I. Winkleri* Brem. Bull. J. Bot. Brit., XIV, 1937, p. 266).

? Kloss 19136, For. Dept. B.N.B. 4256, 4276 (all det. *I. stenophylla*): corolla-tube 3-3.8 cm. long, limb 2.5-3 cm. wide, petals .6-.75 cm. wide.

? For. Dept. B.N.B. 4037: corolla-tube 3.7-4.3 cm. long, limb 2.5-3.3 cm. wide, petals .5-.6 cm. wide.

#### KEY TO THE FORMS OF *I. JAVANICA* VAR. *MULTINERVIA*

Corolla-tube 2-3 cm. long

Limb 1-1.5 cm. wide

Petals .5 cm. wide, blunt, yellow then pinkish orange

Form 1

Petals .3 cm. wide, pointed, rich yellow then intense brick-red

Form 2

Corolla-tube 3-3.8 cm. long

Limb 2.5-3.8 cm. wide

*I. congesta*

Limb 2.3-2.5 cm. wide

Form 10

Limb 2-2.3 cm. wide: petals acute

Form 4

Limb 1.5-2 cm. wide

Form 9

Petals blunt,

Petals .5-.6 cm. wide

Form 5

Petals .3-.5 cm. wide

Form 6

Petals acute, .5 cm. wide			
Petals turning deep brick-red	..	..	Form 7
Petals pale orange buff then pale red	..	..	Form 8
Limb 1-1.5 cm. wide: petals subacute			
Petals .3-.4 cm. wide	..	..	Form 10
Petals .2 cm. wide, narrowly oblong	..	..	Form 11
Corolla-tube 3.8-4.3 cm. long			
Limb 1.2-1.5 cm. wide			
Petals .3 cm. wide, salmon pink	..	..	Form 12
Limb 1.7-2.3 cm. wide			
Petals .5-.6 cm. wide, acute: (leaves narrow, 2.5-6.5 cm. wide)	..	..	Form 13
Petals .3-.4 cm. wide, blunt			
Petals yellow then brick-red	..	..	Form 14
Petals pale reddish pink (leaves 2.5-3.8 cm. wide)	..	..	Form 15
Limb 2.3-2.5 cm. wide			
Petals .6-.7 cm. wide, acute, pale yellow then salmon pink	..	..	Form 16

KEY TO THE FORMS OF *I. JAVANICA* VAR. *PAUCINERVIA*

Flowers yellow, not reddening: "Yellow Javanica"

Corolla-limb 1.5-1.9 cm. wide .. .. Form 17

Corolla-limb 2-2.5 cm. wide .. .. Form 18

Flowers yellow turning red or pink

Flower pale yellow turning pale clear pink: "Pink Javanica" .. .. Form 19

Flower turning orange red to brick-red; "Red Javanica"

Corolla-tube 2-2.8 cm. long

Limb 1-1.5 cm. wide

Petals blunt: leaves thin .. .. Form 20

Petals subacute: leaves coriaceous .. .. Form 21

Limb 1.8-2.3 cm. wide: petals blunt .. .. Form 22

Corolla-tube 2.5-3.8 cm. long

Limb 1-1.3 cm. wide: petals .2 cm. wide, subacute .. .. Form 23

Limb 1.3-1.8 cm. wide

Petals .3-.5 cm. wide, blunt or subacute .. .. Form 24

Limb 1.8-2.2 cm. wide

Petals pointed

Petals .3-.5 cm. wide, elliptic .. .. Form 25

Petals .2-.3 cm. wide, oblong .. .. Form 26

Petals blunt, .4-.6 cm. wide .. .. Form 27

Limb 2-2.5 cm. wide: petals .4-.6 cm. wide, acute .. .. Form 28

Corolla-tube 3.8-5 cm. long: petals .3-.5 cm. wide, acute

Limb 1.7-2 cm. wide .. .. Form 29

Limb 2-2.5 cm. wide .. .. Form 30

## Form 1

Corolla-tube 2-3 cm. long, the limb 1-1.5 cm. wide: petals .5 cm. wide, blunt, yellow then pinkish orange.

*Malayan Collections*

Kelantan; Corner 38443.

Penang; Ridley s.n. 1900 (P. Tikus).

Trenghganu; Rostado s.n. Feb. 1904.

Singapore; (cult. in Hort. Bot.) Corner 30795 (det. *I. congesta*), Nur s.n. 14.6.29 (det. *I. congesta*).

*Siam*

Keith 129 (det. *I. amoena* by Craib).

The two Singapore collections have coarsely veined leaves like *I. congesta* but only 10-13 pairs of side-veins like *I. javanica*. They might be classed with either species.

*Form 2*

As Form 1 but the petals narrower, .35 cm. wide, pointed and turning deep red.

*Malayan Collections*

Perlis; Henderson 22950.

Penang; Curtis s.n. (cult. Bot. Gdns.).

Kelantan; Corner 33434.

(? Selangor; For. Dept. 17493).

*Siam*

Kiah 24360 (det. *I. amoena* by Craib).

*Java*

Hallier 142.

*Form 4*

Corolla-tube 3-3.8 cm. long, the limb 2.2-2.5 cm. wide: petals .6 cm. wide, acute or subacute.

*Malayan Collections*

Singapore; (cult. in Hort. Bot.) Corner.

*Form 5*

Corolla-tube 3-3.8 cm. long, limb 1.5-2 cm. wide: petals .5-.6 cm. wide, turning reddish pink.

*Malayan Collections*

Kelantan; Corner 33437.

*Form 6*

As Form 5 but the petals narrower, .3-.5 cm. wide.

*Malayan Collections*

Kedah; Ridley 8354.

(? Singapore, Ridley s.n. 9.11.1892, Kranji).

*Form 7*

Giant or Common Red *Ixora*

Corolla-tube 3-3.8 cm. wide, limb 1.5-2 cm. wide: petals .5 cm. wide, pointed, turning intensely brick-red.

Leaves rather large, the blade 8-28 × 5-12.5 cm.

*Malayan Collections*

Kedah; Ridley s.n. June 1893.

Kelantan; Corner 33436, s.n. 21.4.37 (Kota Bahru), s.n. 22.4.37 (Kota Bahru).

Perak; Ridley 9710, Seimund s.n. 6.12.25 (P. Lalang), s.n. 8.3.26 (P. Rumbia) s.n. 23.3.26 (P. Rumbia).

Pahang; Burkill s.n. June 1915 (P. Tioman).

Malacca; Seimund s.n. 8.4.21 (P. Jarak).

Singapore; (cult. in Hort. Bot.) Cantley s.n., Nur s.n. 15.8.18, 14.6.29. Corner.

*Anamba Islands*

Henderson 20225.

This is the commonest garden *Ixora* in Malaya, yet one that offers the greatest difficulty in classification. It has generally larger leaves with more numerous veins than *I. javanica*, besides pointed petals, and it flowers continuously all the year, whereas the wild forms of *I. javanica* like those

of *I. congesta* and *I. Lobbii* are seasonal. In the Singapore Botanic Gardens it has for many years been called *I. macrothyrsa* but it does not answer in any detail with the description of that species in Bot. Mag. t. 6853. It seems that dried specimens have never come into the hands of systematists working on the flora of Malaya or of neighbouring countries, unless as Wallich 6152 as I have suggested under *I. fulgens*. It corresponds so remarkably well with Roxburgh's interpretations of *I. fulgens* that it seems to be the species which he intended though whether it is the true *I. fulgens*, taxonomically, has still to be discovered.

It is known, colloquially, as the Common Red *Ixora* or the Giant *Ixora*. The only other garden-variety with which it may be mistaken is *I. congesta* form 9, which differs in its larger, redder flowers that develop seasonally, its much less bushy habit and its more numerous side-veins in the leaf.

*Form 8*

As Form 7, but the petals pale orange-buff turning pale red.

*Malayan Collections*

Kelantan; Corner 33435.

Trengganu; Holtum s.n. 10.5.25 (K. Trengganu).

Singapore; (cult. in Hort. Bot.).

*Form 9*

As Form 7 but the corolla-limb 2-2.3 cm. wide.

*Siam*

Haniff & Nur 3910 (det. *I. amoena* by Craib).

*Malaya*

Pahang; Corner 29910.

*Form 10*

As Form 7 but the corolla-limb 1-1.5 cm. wide.

*Malayan Collections*

Kedah; Curtis 2607, Ridley 8354: (both det. *I. amoena* by Craib).

Penang; Ridley 7092.

Perak; Kunstler 2247.

*Form 11*

As Form 10, but the petals only .2 cm. wide, narrowly oblong.

*Malayan Collections*

Province Wellesley; Ridley 10776.

*Form 12*

Corolla-tube 3.8-4.3 cm. long, limb 1.2-1.5 cm. wide; petals .3 cm. wide, subacute, salmon-pink, never red.

*Malayan Collections*

Kelantan; Corner s.n. 22.4.37 (Kota Bahru).

*Form 13*

Corolla-tube 3.8-4.3 cm. long, limb 1.7-2.3 cm. wide; petals .5-6 cm. wide, pointed.

*Malayan Collections*

Trengganu; Moysey 33891.

*Form 14*

As Form 13 but the petals narrower, 3-4 cm. wide, blunt, turning deep brick red.

*Malayan Collections*

Kelantan; Corner s.n. April 1937 (2 collections).

*Form 15*

As Form 14 but the flowers pale reddish pink.

*Malayan Collections*

Kelantan; Corner s.n. 22.4.37 (Kota Bahru).

*Form 16*

Corolla-tube 3.8-4.3 cm. long, limb 2.3-2.5 cm. wide: petals 6-7 cm. wide, pointed, pale yellow then salmon pink.

*Malayan Collections*

Kelantan; Corner 33438, Nur & Foxworthy 12255.

*Form 17*

Corolla-tube 2.5-3 cm. long, limb 1.5-1.9 cm. wide: petals blunt, persistently light orange buff or apricot-buff never reddening.

*Malayan Collections*

Singapore; (cultivated) Corner 34513, Hort. Bot. Sing. s.n. 10.8.21.

This and the following form are cultivated in Malayan gardens as a "Yellow Ixora" but they may be more accurately known as the "Yellow Javanica", to distinguish them from the "Yellow Coccinea". The colour is not a true yellow but a pale dull orange slightly pink.

*Form 18*

As Form 17 but the corolla-limb wider, 2-2.5 cm. wide.

*Malayan Collections*

Singapore; (cult.).

*Form 19*

Corolla-tube 3.2-3.8 cm. long, limb 2-2.6 cm. wide: petals 4-6 cm. wide, pointed, elliptic, pale yellow buff turning wholly pale rose pink, never red.

*Malayan Collections*

Negri Sembilan; Corner 31502.

This collection is from a rather narrow-leaved shrub, 10 ft. high, growing in thickets by a sluggish, forest stream beside the main road from Tampin to Gemas. Plants with rather broader leaves are also cultivated in Malayan gardens as a "Pink Ixora": they may be known more accurately as the "Pink Javanica".

*Form 20*

Corolla-tube 2-2.8 cm. long, limb 1-1.5 cm. wide: petals 3-4 cm. wide, blunt. Leaves thin.

*Malayan Collections*

Trengganu; Rostado s.n. Feb. 1904 (K. Kemaman).

*Form 21*

As Form 20 but with subacute petals and very coriaceous leaves.

*Malayan Collections*

Singapore; (cult. in Hort. Bot.) Nur s.n. 22.6.29.

*Form 22*

As Form 20 but the corolla-limb wider, 1.8–2.3 cm.

*Sumatra*

Ridley 8979 (Penasa) (det. *I. Lobbiai* ex. enum. Herb. Kew).

*Form 23*

Corolla-tube 2.7–3.3 cm. long, limb 1–1.3 cm. wide: petals 2 cm. wide, subacute.

*Malayan Collections*

Perlis; Ridley 14997.

Penang; (cult. in Hort. Bot.) Curtis s.n. 29.11.02.

*Siam*

Setul; Ridley 14998 (det. *I. amoenae* by Craib).

*Form 24*

Corolla-tube 2.8–3.5 cm. long, limb 1.3–1.8 cm. wide: petals 3–5 cm. wide, blunt to subacute.

*Malayan Collections*

Kelantan; Henderson 19572, 22595 (both det. *I. stenophylla*).

Trengganu; Corner 25924 (det. *I. stenophylla*).

Penang; (cult. in Hort. Bot.) Curtis s.n. Aug. 1900.

Perak; Corner s.n. 29.7.36 (Pangkor), Ridley 7187, 10276.

Pahang; Burkill and Haniff 17342, 17602, Burn Murdoch 158, 319, Cons. For. 4767, Evans 13231 (det. *I. concinna* ex enum. Herb. Kew), Henderson s.n. 19.8.29 (Kuantan), Ridley s.n. 19.8.89 (Pekan), s.n. 1891, s.n. 25.8.91 (Pasir Mandi, det. *I. concinna*), 1085 (det. *I. concinna*), Seimund 962, Walker 23326.

Selangor; Hume 7107, Ridley s.n. 1.1.21 (Klang Gates), 13408.

Malacca; Burkill 1327, Derry 84, Seimund 1139.

Johore; Corner 25960, 25961, Henderson 18218.

Singapore; (cult. in Hort. Bot.) s.n. 31.10.21, Nur s.n. 12.6.24, s.n. 9.9.24.

*Anumba and Natuna Islands*

Henderson 20450, v. Steenis 966.

*Java*

v. Steenis 5416.

*Sumatra*

v. Steenis 3847.

This is one of the common wild forms of *I. javanica* in Malaya. It is abundant by the sea-shore and, as a narrow-leaved bush of the flood-zone, by riversides.

*Form 25*

Corolla-tube 2.8–3.8 cm. long, limb 1.8–2 cm. wide: petals 3–5 cm. wide, elliptic, pointed.

*Malayan Collections*

Trengganu; Rostado 11971, s.n. 1904 (Bundi).

Pahang; Ridley 1075.

Singapore; (cult. in Hort. Bot.) Burkill s.n. 23.10.17, Corner s.n. 26.10.37.

*Form 26*

As Form 25 but the petals narrower and oblong, 2–3 cm. wide: corolla-tube 2.5–3 cm. long.

*Malayan Collections*

Singapore; (cult.) Corner s.n. 26.10.37.

*Form 27*

Corolla-tube 3.2-3.8 cm. long, limb 1.7-2 cm. wide: petals 4-6 cm. wide, *blunt*.

*Malayan Collections*

Kedah; Ridley 15890 (Pulau Rawei).

Johore; Holttum 24958 (Pulau Pelandok).

*Form 28*

Corolla-tube 3-3.8 cm. long, limb 2-2.5 cm. wide: petals 4-5 cm. wide, *acute*.

*Malayan Collections*

Pahang; Ridley 2114 (det. *I. concinna*).

Johore; Ridley 15403 (rather narrow-leaved, riverside shrub).

*Form 29*

Corolla-tube 3.8-5 cm. long, limb 1.7-2 cm. wide: petals 3-5 cm. wide, *acute*.

*Malayan Collections*

Kelantan; Nur and Foxworthy 12087.

Pahang; Burkill and Haniff 16107, Cons. For. 5176.

*Java*

Koorders 39079.

*Sumatra*

Robinson and Kloss s.n. 19.3.14 (Korinchi Exped.: det. *I. amoena*).

All these collections are from riverside shrubs with small, narrow leaves, up to 12 × 2.5 cm.

*Form 30*

As Form 29 but the corolla-limb wider, 2-2.5 cm.

*Malayan Collections*

Perak; Ridley 14312.

Pahang; Kiah and Strugnell 23981 (det. *I. stenophylla*).

Both collections are from narrow-leaved, riverside shrubs (blade 6-20 × 1.5-3 cm.).

*Without open Flowers*

Kedah; Dolman 21705.

Perak; Burkill 12435, Wray 3448.

Pahang; Burkill and Haniff 16936 (riverside bush with lanceolate leaves: det. *I. stenophylla*).

# COLLECTIONS INTERMEDIATE BETWEEN *I. javanica* AND *I. lobbia*

*Borneo*

Elmer 20678, 21049, Wood 2262.

These three collections have been distributed as *I. lobbia* but their leaves, which are narrowly oblong-elliptic (10-25 × 3.5-8.5 cm.), are simply pointed or subacute (not acuminate) and have only 10-16 pairs of side-veins. Therefore they are not *I. lobbia*. I think they are extreme forms of *I. javanica* but the *Ixoras* of Borneo are too little known to be rightly understood.

COLLECTIONS INTERMEDIATE BETWEEN *I. CONGESTA*  
AND *I. JAVANICA*

Perak; Murton 43 (det. *I. congesta*: but more like *I. javanica* form 7 with leathery leaves).

Selangor; Hume 8433 (det. *I. congesta*: but more like *I. javanica* form 7 with leathery leaves and remarkably strong veins; "flowers pink" on the field note does not apply to *I. congesta*).

Malacca; Alvin 781 (det. *I. congesta*: but with 11-17 pairs of side-veins; exactly between *I. javanica multinervia* and *I. congesta*).

Singapore; Baker s.n. 17.7.17 (Gardens Jungle), Goodenough 5289 (Selitar), Ridley 5067, 5674, s.n. 1892 (Chan Chu Kang), s.n. 1892 (Changi): (all these collections, having 10-16 pairs of side-veins, seem exactly between *I. congesta* and *I. javanica*).

**I. Kingstonii** Hook. fil.

Fl. Br. Ind. III, 1880, p. 140.

A shrub or small tree up to 9 m. high, glabrous except for the puberulous branches of the inflorescence, or even wholly glabrous.

*Leaf-blade* 15-30 × 5-9 cm., rather narrowly oblong elliptic or narrowly obovate, more or less acuminate, the base cuneate, thinly coriaceous; *side-veins* 13-24 pairs, not distinctly inarching; *petiole* 6-1.5 cm. long.

*Corymb* 5-12 cm. wide, *dense*, sessile or with a peduncle up to 3 cm. long, the branches articulate, 2-3 mm. wide, *rather short*, finely and often sparsely puberulous, or even glabrous: *bracts*, at the base of the main branches, 6-12 × 4-7 mm., broadly lanceolate, subacute, *rather leafy*: *bracteoles* 3-6 × 2.5-3.5 mm., oblong, acute or subacute like the sepals: *flowers yellow-red*, ? inodorous: *sepals* 2.5-5 × 1.5-2.5 mm., *longer than the ovary*, glabrous, oblong, blunt or subacute, *unequal in length in the same flower*: *corolla-tube* 3-3.5 cm. long, glabrous, the petals 6-7 × 3.5-5 mm. elliptic, blunt or subacute.

*Distribution*:—Malaya.

*Type*:—Griffith 2996 (Malacca).

*Collections*:—Perak; King's Collector 5972, Burn Murdoch 202, Wray 726, s.n. 1889 (Changkat Serdang).

Selangor; Curtis 2346, Ridley 5674, 7300, 8536, s.n. Aug. 1904 (Sempang Mines): For. Dept. 122, 4941, 8274, 24253.

Malacca; Goodenough 1271, Hervey s.n. 20.9.90, Ridley s.n. 1890 (S. Baru).

Johore; Curtis s.n. April 1901 (Muar).

Very little is known of this species which has seldom been collected within the last thirty years. I interpret the species from the specimens identified by King in the Singapore Herbarium. According to King, and to the field-note on Burn Murdoch's collection, the flowers are yellowish red, perhaps yellow turning red and this character distinguishes it radically from the similar species *I. multibracteata*, *I. merguensis* etc. with which it may easily be mistaken in the herbarium. It is most like *I. umbellata* but differs in the narrower, more coriaceous leaves, the broader bracts, stouter branches of the corymb as well as in the colour of the flower.

**I. Lobbii** King et Gamble

Glossy Ixora

Mat. Fl. Mal. Pen. 4, 1904, p. 152.

Synonyms:—

*I. Lobbii* var. *angustifolia* K. & G., loc. cit. p. 153 *pro parte*.*I. fulgens* Roxb. sensu Hook. fil., F.B.I. 3, p. 146 *pro parte* (fide King and Gamble).*I. aurea* var. *major* Ridley, Journ. Bot. 72, 1914, p. 252.An evergreen shrub or treelet, 1-10 m. high like *I. javanica*.

Leaf-blade 10-28 × 4-8.5 cm., lanceolate-elliptic to lanceolate-obovate, more or less suddenly acuminate, widest at or above the middle, the base gradually tapered, dark glossy green, with 12-26 pairs of lateral veins inclined forward and distinctly inarching near the margin.

Sepals subacute to acute.

Petals yellow or pinkish yellow turning red, generally acute.

Distribution:—Lower Siam, Malaya, Borneo, Sumatra, Anamba and Natuna Islands.

**var. stenophylla** var. nov.

Red River Ixora

Synonyms:—

*I. stenophylla* (Korth.) Kuntze sensu Ridley, Trans. Linn.

Soc. 3, 1894, p. 311, Fl. Mal. Pen. 2, 1923, p. 94.

*I. salicina* Ridley, Journ. Bot. 72, 1914, p. 253.

Lamina lanceolata, 7-2.3 cm. lata, utrinque attenuata, apice longe acuminata, costis lateralibus utrinsecus 8-15; frutex riparius.

A riverside shrub 5-3 m. high.

Leaf-blade 3.5-15 × 7-2.3 cm., lanceolate, gradually tapered to the long acuminate apex and to the base, broadest at the middle, with 8-15 pairs of lateral veins distinctly inarching at the margin and making a wide angle with the midrib; petiole 2-1.3 cm. long; stipular point up to .9 cm. long.

Distribution:—Malaya, Borneo, Palawan (?).

Type:—Ridley 2215 (Tahan River, Pahang).

This species has hitherto been attributed to Loudon for authorship. On turning to Loudon's reference, (Encycl. Suppl. II, p. 1543) it will be seen, however, that there is no description. Loudon based his name on *Pavetta Lobbii* Teysm. et Binn., which is also a *nomen nudum* as well as a *nomen invalidum* from its manner of publication. Hence the authorship must be attributed to King and Gamble who first described it. These authors give a reference to "Pavetta Lobbii Teysm. et Binn. in Miq. Ann. Mus. Lugd. Bat. IV, 194", but I cannot find the name on this page, nor in the whole volume, nor in any other work of Miquel's. Misgivings arise, therefore, whether the name *I. Lobbii* has not been antedated because the species is one of the commonest in western Malaysia. This is, unfortunately, impossible to decide from the earlier descriptions of red Ixoras and so one must wait until herbaria have been ransacked for the types of the old species. Surely it did not escape Miquel.

The narrowly obovate, acuminate, many-veined, dark glossy green leaves and the acute petals will generally distinguish *I. Lobblii*. But there are narrow-leaved collections of *I. congesta* which seem to pass into *I. Lobblii* and likewise many-veined collections of *I. javanica*, particularly of *I. javanica retinervia* which has the acuminate blade, pointed petals, and inarching veins of *I. Lobblii*.

My basis for the identification of the Malayan material with *I. Lobblii* is the specimens so named by King in the Singapore Herbarium. King doubtless saw the specimen of Teysmann and Binnendijk in the Kew Herbarium. It seems that the species is not recognised outside Malaya, though Bremekamp reports it from the neighbouring islands of the Rhio Archipelago.

The variety *angustifolia* King and Gamble, as pointed out by Ridley, is a mixture of a narrow, lanceolate-leaved state of *I. Lobblii* and a small lanceolate-leaved riverside shrub. Of the collections cited by King and Gamble there belong to the first state Wray 519, Scortechini 1893 and King's collector 2718, and to the second only Ridley 2215. Therefore Ridley referred the first state to var. *angustifolia*, defined it anew and made Wray 519 as the lectotype: the second state he referred to the Bornean *Parcetta stenophylla* Korth. as *I. stenophylla* Ridley which name he changed subsequently to *I. salicina* as he considered the Bornean plant to be different. As regards var. *angustifolia* sensu Ridley, I am unable to distinguish it because there is every gradation to the typical, slightly broader-leaved state of *I. Lobblii*, and the variety has no particular habitat or distribution, specimens from all parts of Malaya being referable to it. Hence I merge this variety with *I. Lobblii*. On the other hand, *I. stenophylla* sensu Ridley (= *I. salicina*) is a well-marked riverside shrub with narrow, shorter leaves and fewer veins than typical *I. Lobblii* and in Malaya, it appears to be limited to the rocky streams that are the tributaries of the rivers flowing into the China Sea: in which relation, may be, it occurs also in Sarawak and probably, Palawan. Nevertheless, I am unable to follow Ridley in maintaining his *I. stenophylla* (*I. salicina*) as a species. The low shrubs by the banks of swift flowing rivers that are prone to frequent and sudden flooding, like the Tahan and its tributaries, have small narrow leaves very different at first glance from those of *I. Lobblii* in the quiet, deep shade of the forest, but the smaller and more precipitous the river the less are its riparian growths subject to flooding and the larger are the leaves and the bushes so that it is not easy to decide whether they should be classed as "*stenophylla*" or "*Lobblii*", e.g. the Johore

collection of var. *stenophylla* (shrubs 2-4 m. high). I prefer, therefore, to reduce *I. stenophylla* sensu Ridley as a variety of *I. Lobbii* without any decision about its identity with *Pavetta stenophylla* Korth. The narrow-leaved, riparian form of *Melastoma malabathricum* affords a comparable case.

The variety *stenophylla* has been confused in Malaya with the narrow leaved riparian states of *I. javanica* but these differ in having fewer lateral veins, which do not inarch distinctly but are directed obliquely forward, and, generally, in having less acuminate leaves and smaller flowers with blunt or subacute petals. The type of *I. aurorea* var. *major* Ridley, namely Nur 20007, is a riverside-form intermediate between *I. Lobbii* and var. *stenophylla*, perhaps a riverside-form of my form 7.

*I. salicifolia* (Bl.) (= *I. fulgens* Roxb. var. *salicifolia* K. & V.) differs from *I. Lobbii* var. *stenophylla* in having much longer, linear-oblong leaf-blades (12-38 × 1.2-2.5 cm.) with many more pairs of lateral veins (15-30 prs.). Nothing approaching *I. salicifolia* has been found in Malaya: and *I. Lobbii* seems not to occur in Java.

*I. javanica* var. *retinervia* may well be mistaken for *I. Lobbii* var. *stenophylla* in the herbarium. The var. *retinervia* is a small tree, or shrub, of lowland forest, not a riverside bush: its leaves are broader than those of var. *stenophylla*, have on the whole fewer lateral veins and are oblong elliptic to elliptic. It seems, moreover, that the Malayan specimens of var. *retinervia* are always distinguishable by their smaller flowers. Nevertheless, I feel there is some close relation between the two.

#### KEY TO THE FORMS OF *I. LOBBII*

- Corolla-tube 2-2.7 cm. long
  - Limb 1-1.3 cm. wide: petals .25 cm. wide, acute .. Form 1
- Corolla-tube 2.5-3.8 cm. long
  - Limb 1.2-1.8 cm. wide: petals .2-4 cm. wide
    - Petals acute .. .. . Form 2
    - Petals blunt .. .. . Form 3
  - Limb 2-2.5 cm. wide: petals .4-6 cm. wide, acute .. Form 4
  - Limb 2.7-3.3 cm. wide: petals .5-8 cm. wide, acute .. Form 5
- Corolla-tube 3.8-5 cm. long
  - Petals .4-5 cm. wide, acute
    - Limb 1.2-1.7 cm. wide: tube 3.7-5 cm. long .. Form 9
    - Limb 1.8-2.3 cm. wide: tube 3.7-4.3 cm. long .. Form 6
  - Petals .5-8 cm. wide: tube 3.7-5 cm. long
    - Limb 1.8-2.5 cm. wide: petals .5-6 cm. wide .. Form 7
    - Limb 2.5-3.3 cm. wide: petals .7-8 cm. wide .. Form 8

#### KEY TO THE FORMS OF *I. LOBBII* VAR. *STENOPHYLLA*

- Corolla-tube 3-3.7 cm. long: petals .4-6 cm. wide
  - Limb 1.7-2 cm. wide .. .. . Form 10
  - Limb 2.2-3 cm. wide .. .. . Form 11

Corolla-tube 3.7-5 cm. long

Limb 2-2.8 cm. wide: petals 4-6 cm. wide .. Form 12

Limb 2.8-3.5 cm. wide: petals 5-7 cm. wide .. Form 13

*Form 1*

Corolla-tube 2-2.7 cm. long, limb 1-1.3 cm. wide; petals .25 cm. wide, acute.

*Form 2*

Corolla-tube 3.2-3.8 cm. long, limb 1.25-1.8 cm. wide: petals .25-4 cm. wide, oblong, acute.

*Malayan Collections*

Kedah; Henderson 21264.

Penang; Burkill 813, 2599, Curtis s.n. March 1892 (Govt. Hill), s.n. April 1884, 479.

Province Wellesley; Ridley 6991.

Perak; Cantley s.n., Curtis 3338, Fox 158, For. Dept. 11567, Ridley s.n. 1892 (K. Kangsar), s.n. 1892 (Maxwell's Hill), Scortechini s.n.

Pahang; Henderson 10695, Kiah 23901.

Selangor; Burkill 7580, Cons. For. 2278, Hume 9254, Pestana 28430.

Malacca; Alwins s.n., Alwins 60, Burkill 462, 1321, Corner s.n. 23.2.36, Derry 10, Hullett s.n. April 1888 (Mt. Ophir).

Singapore; Cantley s.n., Corner s.n. 1.4.37, Nur s.n. 23.2.29, Ridley 5673.

*Anumba Islands*

Henderson 20124.

This is the commonest form of *I. Lobtii*, but whether it is taxonomically the typical state I do not know.

*Form 3*

as Form 2 but the petals blunt to subacute.

*Siam*

Curtis 3258 (Kasoom).

*Borneo*

Moulton 6703/15 (Upper Baram, Sarawak: det. *I. cf. amoena*).

*Form 4*

Corolla-tube 3-3.8 cm. long, the limb 2-2.5 cm. wide: petals 4-6 cm. wide, lanceolate, acute.

*Malayan Collections*

Pahang; Henderson 21655 (Pulau Tioman).

*Anumba Islands*

Henderson 20185 (det. *I. javanica*).

*Form 5*

Corolla-tube 3-3.8 cm. long, the limb 2.7-3.3 cm. wide: petals 5-8 cm. wide, acute.

*Sumatra*

Ridley 8970 (Batang Mandan, det. *I. fulgens*).

Except for its short corolla-tube, this form agrees with Form 8. Ridley's collection has, however, much smaller leaves than is general in the collections of Form 8.

*Form 6*

Corolla-tube 3.8-4.3 cm. long, the limb 1.8-2.3 cm. wide; petals 4-5 cm. wide, elliptic, acute.

*Malayan Collections*

Pahang; Burkill and Holtum 8607, Henderson 10584, Nur 11179.

*Sumatra*

Posthumus 724 (Djambi; det. *I. javanica*).

*Form 7**Ixora Sedili*

Corolla-tube 3.8–5 cm. long, limb 1.8–2.5 cm. wide; petals .5–.6 cm. wide, elliptic, acute: (corymb branches pale green in 32293).

*Malayan Collections*

Johore; Corner 28166, 30787, 30962, 32293, 32495, Fielding s.n. Oct. 1892 (Pulau Tinggi).

This fine *Ixora* is known only from the watershed of the Sedili River in the East of Johore and from the island, P. Tinggi, off the East Coast of Johore. One may expect it therefore in Borneo, where its nearest ally, Form 8, occurs. It commonly develops into a spindly tree, 15–25 ft. high, with chocolate brown, cracked bark; the leaves have rather large, thinly leathery, dark glossy green blades which in shape and venation are inclined to resemble those of *I. congesta*, though they are always acuminate and generally more or less obovate and narrower. The more numerous veins and pointed petals distinguish it from *I. congesta*. Form 10: it seems also to have a different distribution but our knowledge of the flora on the East side of Malaya is yet very meagre.

*Form 8**Giant Glossy Ixora*

As Form 7 but the corolla-limb 2.5–3.3 cm. wide, the petals .65–.8 cm. wide: (corymb branches pale green in 32292).

*Malaya*

Johore; Corner 32292.

*Borneo*

Allen 629 (Payao R., B.N.B., det. *I. congesta*).

Moulton 78 (Baram R., Sarawak, det. *I. fulgens*).

This is the finest red-flowcred *Ixora* that I have seen. The big shining flowers contrast splendidly with the dark glossy leaves.

*Form 9*

Corolla-tube 3.5–5 cm. long, limb 1.2–1.7 cm. wide, petals .4–.5 cm. wide.

*Malayan Collections*

Perak; Anderson 152, Burkill and Haniff 12713, Haniff 21043, Ridley 152, Wray s.n. 1889 (Taiping).

This variety from the Perak Hills has lanceolate leaves 12–24 × 2–5 cm. It much resembles var. *stenophylla* but the longer leaf-blade and a habit that is not riparian distinguish it.

## STERILE, FRUITING OR NOT FLOWERING COLLECTIONS

*Malaya*

Penang; Curtis s.n.

Province Wellesley; Burkill 6538, Ridley s.n. Dec. 1895.

Perak; Haniff 10555, Ridley s.n. March 1896 (Gunong Tung-gul), Wray 519, 952, 2891, 3449.

Pahang; Burkill & Haniff 17003, For. Dept. 28273, Machado 11569.

Selangor; Ridley s.n. June 1889 (K. Lumpur).  
 Negri Sembilan; Nur 797.  
 Malacca; Alwins s.n., Burkill 6419, Derry 966.  
 Johore; Corner s.n. 11.3.37, Ridley 11324, s.n. March 1908  
 (S. Tebrau), s.n. Aug. 1908 (Sedenah).  
 Singapore; Cantley 83, Hullett s.n. 1893 (Changi Road).

*Sumatra*

Bartlett and La Rue 29 (det. *I. salicifolia*).  
 Bunnemeyer 3204 (det. *I. salicifolia*).

*Anamba Islands*

v. Steenis 897 (det. *I. javanica*).

*Borneo*

For. Dept. B.N.B. 4705.

### FORMS OF VAR. *STENOPHYLLA*

*Form 10*

Corolla-tube 3-3.7 cm. long, limb 1.7-2 cm. wide: petals  
 .4-.6 cm. wide.

*Malayan Collections*

Johore; Holttum 10870.

*Form 11*

As Form 9 but the corolla-tube 2.2-3 cm. wide.

*Malayan Collections*

Trengganu; Corner 25825, s.n. 24.6.32 (Kemaman).

*Borneo*

Ridley 12443 (Puak) (det. *I. stenophylla*).

*Philippine Islands*

Merrill 1362 (Palawan: det. *I. fulgens*).

*Form 12*

As Form 11 but corolla-tube 2-2.8 cm. wide, petals .4-.6  
 cm. wide.

*Malayan Collections*

Kelantan; Haniff & Nur 10280.

Pahang; Burkill and Haniff 16562, Corner s.n. Sept. 1937  
 (S. Tahan) (2 collections), Haniff and Nur 8089, Ridley  
 2215, Seimund 496, 585, Strugnell 22463.

*Form 13*

As Form 11, but corolla-limb 2.8-3.5 cm. wide, petals  
 .5-.7 cm. wide.

*Malayan Collections*

Johore; Corner 32490.

Pahang; Corner s.n. 7.9.37 (S. Tahan).

### STERILE, FRUITING OR WITHOUT FLOWERS

*Malayan Collections*

Perak; Ridley s.n. Sept. 1890 (Bujong Malacca).

Pahang; Seimund 586, Nur 18924 (det. *I. stricta*).

Johore; Ridley s.n. 1904 (Castlewood).

*Borneo*

Anderson 213 (Gunong Rumpit), Ridley 11743 (Bidi).

COLLECTIONS BETWEEN *I. LOBBII* AND  
VAR. *STENOPHYLLA*

Johore; Nur 20007 (type of *I. aurorea* var. *major* Ridley):  
Corner 31434.

These collections may well be narrow leaved riverside plants of my form 7. Their leaves are not lanceolate enough for true var. *stenophylla*.

***I. micrantha* Ridley**

Mountain Flora

Journ. St. Br. R. As. Soc. 61, 1912, p. 21.

Synonym:—

*I. patens* Ridley Journ. St. Br. R. As. Soc. 79, 1918, p. 83.

A mountain shrub or small tree to 8 m. high: glabrous except for the puberulous branches of the corymb.

Leaf-blade 9-18 × 3-8 cm., oblong elliptic or slightly obovate, more or less acuminate, the base cuneate or rather abruptly rounded, scarcely coriaceous, with 9-16 pairs of side-veins directed obliquely forward and anarching near the edge: petiole 3-1.5 cm. long: stipular point 3-7 mm. long.

Corymb 6-20 cm. wide, 5-14 cm. high, large, sessile or very shortly stalked, the branches articulate and puberulous, the flowers densely crowded and more or less sessile, very fragrant: sepals as long as or shorter than the ovary, subacute: corolla-tube 3-9 mm. long, pink or red, or yellow turning red; petals 2.5-3 × 1.5 mm., oblong, blunt or subacute, reflexed along the tube, yellow gradually turning red.

Berry 1 cm. wide, subglobose, scarcely sulcate.

Distribution:—Malaya; apparently only in the mountains, 1000-1700 m.

Typus:—Ridley 15830, Sempang Mines, Selangor, April 1911.

KEY TO THE FORMS

Corolla-tube 3-5 mm. long	..	..	Form 1
Corolla-tube 7-9 mm. long	..	..	Form 2

Collections

Form 1:—Haniff 2455 (Perak, G. Hijau), For. Dept. 27552 (Pahang), Anderson 31 *pro parte* (Perak, G. Hijau).

Form 2:—Anderson 31 *pro parte*, Burkill and Haniff 12629, Henderson 11819 (all three from G. Hijau, Perak), Wray 3934 (Perak, G. Bubu), Hose 78 (Selangor, Fraser's Hill), Ridley 15830 (Selangor), Robinson s.n. 19.1.93 (Selangor, G. Menkuang: type of *I. patens*).

Without full-grown flowers:—Ridley 9708 (Perak, G. Keledang), 13640 (Pahang, Telom Valley) For. Dept. 28117 (Pahang, S. Lemai), 23394 (Selangor, Fraser's Hill).

This species is closely allied with *I. concinna*, having the same small fragrant flower with yellow corolla turning red, and similar leaves, but it is easily distinguished by its much larger inflorescences with stouter, puberulous branches. Most of the Malayan specimens have been identified with *I. concinna*. Ridley remarked that the species was related to *I. grandifolia* but the bracteate, articulate ramuli of the corymb forbid such an alliance.

I can find no specific difference whatever between the types of *I. micrantha* and *I. patens*. Ridley's statement that *I. micrantha* has only 9 pairs of side-veins to the leaf is wrong: the type-specimen has as many as 13. The differences in size of leaf and corymb, given by Ridley, are trivial and such as occur in any plant.

The collection Wray 3934 is the basis of the record of *I. undulata* in Malaya, being determined as such by King and Ridley. Wray's fieldnote is "flower yellow, tube tinged pink, as the flower gets older it turns to red", but *I. undulata* has white flowers, and this is to me conclusive that Wray's plant is not *I. undulata*: indeed, Wray's plant is identical with the type of *I. micrantha*.

### *I. nigricans* W. et A.

White Needles

Prodr. Fl. Ind. I, 1834, p. 428.

Wight lc. Pl. t. 318.

Synonyms:—

*I. affinis* Don, Gen. Syst. 3, 1834, p. 571.

*I. crubescens* Don, loc. cit.

*I. arguta* King, Mat. Fl. Mal. Pen. 4, 1904, p. 148.

*I. plumea* Ridley, Journ. Str. Br. R. As. Soc. 59, 1911, p. 117.

*I. nigricans* var. *crubescens* Kurz, For. Fl. Burma 2, 1877, p. 24.

*I. nigricans* var. *arguta* Hook. f., F.B.I. 3, 1880, p. 149.

*I. affinis* var. *arguta* Craib, Fl. Siam. En. 2, 1934, p. 147.

*I. affinis* var. *plumea* Craib, loc. cit. p. 148.

*Pavetta acutiflora* Korth. Ned. Kruidk. 2. 1851, p. 262 (fide auctt.).

*Pavetta subulata* Teysm. and Binn. Ned. Kruidk. Arch. 3, 1855, p. 403 (fide auctt.).

A bush or treelet to 4 m. high, flowering at 1 m., glabrous except for the puberulous branches of the corymb.

Leaf-blade 8–20 × 2.5–8 cm., narrowly elliptic to elliptic obovate, acuminate, gradually tapered to the base, the upper leaves on flowering branches often shorter, broader, and ovate or even cordate, membranous, blackening in drying; side-veins 7–12 pairs, not or vaguely inarching; petiole .5–1.5 cm. long; stipule-point .3–.8 cm. long.

Corymb 5–15 cm. wide, rather lax, erect, sessile or with a peduncle up to 4 cm. long, the branches slender, articulate, more or less puberulous, often reddish: bracts 4–8 × .1 mm. linear-lanceolate: bracteoles like the sepals but slightly broader: flowers white, fragrant often only faintly: sepals .7–1.5 mm. long, linear-lanceolate, glabrous, as long as, longer than or shorter than the ovary (ca. 1 mm. long), green: corolla-tube .8–1.3 cm. long, glabrous, the mouth also glabrous, white: petals 4–6.5 × 1–1.5 mm. linear-oblong, acute or becoming blunt on expansion, recurved against the tube; style projecting 3–6 mm.: ovary green or purplish.

Distribution:—India, Indo-China, Siam, Malaya, Sumatra, Anamba and Natuna Islands, Java, Bali.

Type:—Wight 1835.

Collections:—

Siam; Haniff and Nur 3590, 3851, Keith 277, Ridley 15098. Perlis; Ridley 14995, 15097, Henderson 23007.

Kedah; Best 21213, Curtis 3206, Holtum 15083, Ridley 8299.  
 Kelantan; Corner s.n. 1.5.37 (Kota Bahru).  
 Trengganu; Corner s.n. 1.5.37 (S. Besut).  
 Penang; Curtis 986, For. Guard. s.n. Ayer Itam, s.n. Balek Pulau.  
 Province Wellesley; Ridley 7013.  
 Perak; Curtis 1303, Haniff 14184, Henderson 10074, 10295, King's Collector 870, 10901, Ridley 7188, 11905, s.n. 1891, s.n. 1898, Wray 2135.  
 Pahang; Burkill s.n. June 1915 (P. Tioman), Evans 13229, Henderson 10665, 21678, Nur 18552.  
 Selangor; Ridley 8240, s.n. 1897.  
 Negri Sembilan; Burkill 4962.  
 Malacca; Alvin 1034.  
 Johore; Fielding s.n. 1892 (P. Dayong), Henderson 18212.

### var. *ovalis* Pitard

Fl. Gen. Indoch. 3, 1924, p. 322.

Synonyms:—

*I. lucida* Hook. f., F.B.I. 3, 1880, p. 148.

*I. lucida* var. *densipila* Craib, Fl. Siam Enum. 2, 1934, p. 161.

Leaf-blade 5-14 × 2-6 cm., broadly elliptic to ovate-elliptic, generally broadly rounded at the base, the apex distinctly acuminate, drying shiny, the side-veins arising at a wider angle from the midrib and distinctly inarching near the margin; petiole rather short, 2-7 mm. long.

Corolla-tube 2-3 cm. long, puberulous, the mouth glabrous or more or less bearded; petals 5-7 × 2 mm.; ovary and sepals puberulous.

Distribution:—Indo-China, Siam, Malaya (north).

Type:—Pierre's specimen from Tan-Huyen (prov. Bien-hoa).

Collections:—

Siam; Kerr 7108.

Penang; Curtis 2451, Nur 1478.

Kelantan; Henderson s.n. 22.10.28 (Gua Ninek), s.n. 15.7.35 (Gua Teja).

Perak; Henderson 23856, Ridley s.n. Aug. 1909 (K. Kenering).

King's reason for rejecting the name *I. nigricans* for the Malayan specimens in favour of *I. arguta* rested on a misunderstanding. King regarded the Wallichian collection 6154 as the type of *I. nigricans* and, having discovered that the number included a variety of plants, he rejected *I. nigricans* as a confused species. But the publication of *I. nigricans* dates from Wight and Arnott's Prodrum where, in the paragraph following the description, it was clearly stated that the description was based on the collection 1335 of Wight's with the remark that this collection was not included under the Wallichian aggregate 6154. Wight's illustration is taken from his own collection and it undoubtedly depicts the Malayan species. Wight and Arnott described the corolla-tube as three-quarters of an inch long but the illustration shows the corolla-tube 10-12

mm. long as in most Malayan specimens and as described by Koorders and Valetton, King and Pitard. Hence I have no doubt of the identify of our Malayan plants.

Don's species, *I. affinis* and *I. erubescens*, have generally been regarded as identical with *I. nigricans*. They were published in the same year without any indication of priority over *I. nigricans* and, as this name is the better known, Don's have been reduced to synonyms (Bremekamp, Journ. Bot. 75, 1935 p. 296). Craib considered that Don's species were different from *I. nigricans* but gave no reason.

*I. plumea* Ridley is identical with *I. nigricans*. Craib endeavoured to distinguish it as a variety of *I. affinis* on the character of the sepals being longer than the ovary. But I find that there is every gradation to states with the sepals as long as the ovary and those with the sepals shorter: and the differences are trivial, concerning a length of 5-75 mm. Craib also distinguished *I. arguta* King as a variety of *I. affinis* without saying how it differed. The distinction between *I. affinis* and *I. erubescens* lies in the more oblong leaf and shorter petiole of *I. erubescens* according to Craib but he does not give the length of the petiole in either or say from what part of the plant the leaf or the petiole is to be taken for comparison. I consider that none of these distinctions has even varietal value especially when the general variability of the plants in the length of the corolla-tube and petals, the size of the leaf and corymb, and the colour of the ovary has been disregarded.

On the other hand, var. *ovalis* Pitard does seem worth varietal rank through the longer corolla-tube, the different venation and the rounded leaf-base. Its leaves, in fact, throughout the plant are like those just below the corymbs of typical *I. nigricans*. Nevertheless there are some collections intermediate between the two, and the variety has all the important specific characters of *I. nigricans* though Bremekamp excludes it. Craib's *I. lucida* var. *densipila* seems to be only an extreme form of var. *ovalis* with densely puberulous corolla-tube and heavily bearded corolla-mouth. The collection, Curtis 2451, has a rather thinly bearded corolla-mouth whereas all the other Malayan collections have a glabrous mouth.

Of the typical *I. nigricans* the flowering specimens in the Singapore Herbarium can be separated into two forms, those with the corolla-tube 8-9 mm. long and those with the tube 10-13 mm. long. However, the length of the petals does not always vary concurrently there being short-tubed collection with long petals (5.5-6.5 mm.) and long-tubed collections with short petals (4-5 mm. long) as well as *vice versa*.

**I. pendula Jack**

Pink Needles

Mal. Misc. 1, 1820, p. 11.

Synonyms:—

*I. opaca* Don, Gen. Syst. 3, 1824, p. 573.*I. montana* Ridley, Journ. Str. Br. Roy. As. Soc. 79, 1918, p. 82.*I. candida* Ridley, Journ. F.M.S. Mus. 10, 1920, p. 141.*I. pendula* var. *opaca* Ridley, Fl. Mal. Pen. 11, 1923, p. 96.*I. Parkinsoniana* Craib, Kew Bull. 1932, p. 428.

A shrub or small tree up to 8 m. high, glabrous except for the puberulous cyme-branches and corolla-tube, occasionally wholly glabrous or with the corolla-tube glabrous.

*Leaf-blade* 10-35  $\times$  3-12.5 cm., elliptic, oblong-elliptic, lanceolate elliptic or more or less obovate, the apex subacute, acute or distinctly acuminate, the base gradually tapered or rather suddenly rounded, thinly leathery or distinctly so, dull dark green: *side-veins* 12-24 pairs, directed forward and distinctly inarching near the edge: *petiole* .6-1.8 cm. long, rather stout: *stipular point* .2-1 cm. long.

*Corymb* 3-23 cm. wide, deflexed perpendicularly on a long peduncle, 1-28 cm. long, the peduncle and branches generally puberulous and more or less suffused purple, articulate, the corymb terminal or from the twigs behind the leaves and generally with a pair of leaf-like, often sessile and cordate bracts at the base; the flowers not scented: *sepals* varying lanceolate, acute and as long as the ovary (1 mm. long) to bluntly triangular and shorter than the ovary, the ovary and sepals glabrous or more or less puberulous: *corolla-tube* 1.8-3.5 cm. long, deep rose-red, generally puberulous outside, but often glabrous or nearly so, the limb .9-1.6 cm. wide: *petals* 1.5-2.5 mm. wide, oblong, subacute, more or less reflexed along the tube, with reflexed edges, white, or tipped pink, or partly suffused pink.

Distribution:—Siam, Malaya, Sumatra.

Type:—Non extant, the type-locality being Penang.

*Form 1*(=*I. diversifolia* Kurz sensu King and Ridley).*Corolla-tube* 1-1.2 cm. long, the limb .8-.9 cm. wide.

Collections:—

Lower Siam; Haniff and Nur 2718, Kiah 24363.

Malaya; King's Collector 5737, Ridley s.n. July 1909 (Ulu Temango), Wray 3491.

I can distinguish only one species in Malaya which has deflexed, scentless inflorescences, deep pink corolla-tubes and white petals, and such must therefore be *I. pendula* Jack. It is nevertheless exceedingly variable in detail, especially in the leaf. The variable features are the leaf-size, shape, venation and texture, the size of the corymb and the length of the peduncle, the length of the corolla-tube and the hairiness of the cyme-branches and corolla-tube. If one attempted to distinguish varieties or forms reckoning with all these characters, the number would be impractical.

Some of the Penang specimens in the Singapore Herbarium have large, rather blunt, not acuminate, leaves with rather few veins (blade 18-35  $\times$  6-12.5 cm., veins

12-16 pairs): these are Burkill 6898, Curtis 2240, Curtis s.n. July 1887, April 1890, February 1900. On the sheet of Curtis s.n. July 1887 King has written "exactly the same as the type Wallich (Cat. 6127)": this collection is not the type but may be regarded as the neotopotype. Other collections have linear leaves 10-20 2-1 cm. There is, however, such diversity of the leaves in detail, with every intermediate condition, that I do not see how varieties can be maintained on such characters: I have noticed, too, that the leaves on the short flowering twigs are often smaller, more pointed and with rounded bases than those of the stout vegetative shoots.

The size of the inflorescence and the length of the peduncle vary extraordinarily. King distinguished *I. opaca* from *I. pendula* by its short peduncle, 1-5 cm. long, and its erect corymb. The first point indicates merely the lowest part of the range in size of the inflorescence and is connected by all intermediates with the largest. The second point is certainly an error by no means easy to detect from herbarium specimens: the collections Ridley 3071, King's Collector 1061 and 1118, identified by King as *I. opaca* have the typical deflexed inflorescences. Ridley's definition of *I. pendula* var. *opaca* is not applicable, and there is no evidence that it is a mountain form more than a lowland. Hence I reduce *I. opaca* to *I. pendula*, as being founded on an inadequate range of material. The type of *I. opaca* is Wallich 6141 from Penang.

As regards the size of the corolla some collections have the tube 2.2 cm. long with the limb 1.2 cm. wide, others have the tube 3.5 cm. long and the limb 1.6 cm. wide, but most collections have some intermediate size. A few collections have the tube only 1-1.2 cm. long and the limb 8-9 mm. wide and they have been identified with *I. diversifolia* Kurz by King and Ridley. Some of these have unusually large leaves (up to 35 x 18 cm.) but I cannot see any specific difference between them and *I. pendula*, for they have the same characteristic inflorescence and flowers and they display the same diversity of leaf. Whether they are true *I. diversifolia* which comes from Burma and has 'white' flowers I do not know. Hence I am content to regard them as a form only, like the forms of other *Ixoras* variable in size of corolla.

Of *I. montana* Ridley, there is a part of the fragmentary type-collection (Haniff 16310) at Singapore, consisting of two twigs, an inflorescence and two leaf-bases. It is identical with *I. pendula* except for the rather shorter corolla-tube (1.8-2 cm. long) and thus it connects with my form 1. The inflorescence is on a short peduncle like that of *I. opaca* but it is a wide inflorescence typical of *I. pendula*.

Whether the inflorescence was decurved, or the twig bearing the inflorescence was decurved, is now impossible to discover but, as the specimen agrees in all other points with other mountain specimens of *I. pendula*, I have not the slightest hesitation in reducing it

*I. candula* Ridley is merely a narrow-leaved form of *I. pendula* var. *opaca*; that is, of the state of *I. pendula* with a small, shortly pedunculate inflorescence. Specimens of both type-collections are at Singapore: (it seems that the number 6219, given by Ridley, for Robinson's collection at Dayang Bunting should be 6189 as numbered in the Singapore Herbarium). There are numerous intermediates connecting these lanceolate-leaved specimens (with blades only 6-12 15-3 cm.) to the typical *I. pendula*. Both type-collections show the deflexed inflorescence and both have a puberulous ovary as in Craib's *I. Parkinsoniana*. The reason for considering the flowers as white is the field-note "flowers white" to Robinson's unnumbered syntype from Telok Wau, Terutan: it is likely that the pink-corolla-tube was concealed by the expanded white petals and so escaped the notice of the collector.

*I. Parkinsoniana*, according to the collections named by Craib in the Singapore Herbarium, is merely a form of *I. pendula* with puberulous ovary and sepals, short-corolla-tube (15 cm. long) and rather small, though long-pedunculate, corymb. These collections show that the inflorescence was deflexed as in *I. pendula*. Craib does not explain how *I. Parkinsoniana* is to be distinguished from *I. pendula*. If *I. Parkinsoniana* can be split off on the evidence of a puberulous calyx and corolla-tube, what should one do with the other forms of *I. pendula* with puberulous corymb and corolla-tube, puberulous corymb and glabrous corolla-tube, glabrous corymb and puberulous corolla-tube, and those glabrous in all parts? Then add to these variations, all the varieties of leaf-size, texture and venation, of width of corymb and of length of peduncle. To separate such as "species" seems to me not only impracticable in the extreme but also inability to distinguish "the wood for the trees", losing thereby the major aspects of natural features. The specimens named *I. Parkinsoniana* by Craib in the Singapore Herbarium are:—Holtum 15126, Haniff and Nur 3557, Ridley s.n. Jan. 1897 (Langkawi), Haniff 15531 (all from the island of Lankawi).

### ***I. pumila* Ridley**

F.M.S. Mus. Journ. 10, 1920, p. 142.

A dwarf shrub, 30 cm. high, with finely villous stem, petioles and branches of the inflorescence, and thinly villous undersides to the leaves.

*Leaf-blade* 12-18  $\times$  5-7½ cm., obovate elliptic, simply pointed, gradually attenuate to the base, thin: *side-veins* 10-14 pairs directed obliquely forward, not inarching, the tertiary veins rather close and transverse: *petiole* 3-8 mm. long: stipule lanceolate with a long point, 4-6 mm. long.

*Corymb* 5 cm. wide, on a peduncle 4 cm. long, the branches articulate, hairy, erect, the *corolla white*: bracts lanceolate, the lowest pair 10  $\times$  15 mm., the bracteoles like the sepals: *sepals* 2-3 cm. long, lanceolate or linear-lanceolate, acute, hairy, longer than the ovary: *corolla-tube* 3 cm. long, glabrous: the *petals* 5  $\times$  2 mm., oblong, subacute: corolla-mouth glabrous.

*Distribution*:—Malaya.

*Type*:—Evans 13226 (Gunong Senyum, Pahang, June 1917).

This species, known only from the type-collection, should be easily recognised from the hairy stems and undersides of the leaves, the hairy lanceolate sepals and glabrous white corolla as well as from its apparently dwarf habit.

Compare *I. clerodendron* with broad red sepals and *I. Brunonis* with differently shaped leaves, hairy corolla-tube, and longer sepals.

## I. Robinsonii Ridley

Tahan Ixora

Journ. F.M.S. Mus. VI, 1915, p. 154.

A shrub up to 2 m. tall: glabrous.

*Leaf-blade* 7.5-20.5  $\times$  2-7.6 cm., rather narrowly elliptic to broadly lanceolate or lanceolate-obovate, the apex tapered, simply acute or acuminate, the base very gradually tapered into the petiole, leathery, the edge incurved: *lateral veins* 9-18 pairs, passing obliquely out at a wide angle from the midrib, inarching near the edge, the reticulations coarse: *petiole* 5-2 cm. long, rather flattened and woody, passing so gradually into the blade as to have its upper limit indiscernible: stipular point 1-5 mm. long.

*Corymb* 7.5-15 cm. wide, the peduncle 0-2.5 cm. long, the branches red: sepals acute or subacute: corolla-tube 3.8-5 cm. long, the limb 2.3-3.8 cm. wide, the 4 petals .5-9 cm. wide, elliptic, acute, deep salmon pink to scarlet.

*Distribution*:—Malaya (Gunong Tahan, G. Padang and ? neighbouring mountains, 600-1800 m.).

*Type*:—Robinson 5304 (Gunong Tahan, 1300 m. alt.).

### Key to the Forms

Corolla-tube 3.8-4.5 cm. long: limb 2.3-2.8 cm. wide: petals .5 cm. wide	Form 1
Corolla-tube 4.3-5 cm. long: limb 3-3.8 cm. wide: petals .6-.9 cm. wide	Form 2

### Collections

#### Form 1

Pahang; Robinson & Wray 5304 *pro parte* (G. Tahan).

#### Form 2

Kelantan; Henderson 19736 (ca. 650 m. Gua Ninek).

Pahang; Robinson & Wray 5304 *pro parte* (G. Tahan),

Haniff & Nur 8115 (G. Tahan, ca. 1300 m.), Ridley 16244 (G. Tahan 1300 m.).

Trengganu; Moysey 33360 (G. Padang, ca. 1300 m.).

The leathery leaves with extremely attenuate base, stout petiole and coarse reticulation and the mountain habit distinguish this species, the range of which is curiously limited. I believe that one may say that it occurs only in the mid-mountain forest on the quartzite ridges of the Tahan-group of mountains from G. Padang on the Trengganu boundary westward to the Telom River. Nevertheless, there are some Bornean collections from sea-level—one, indeed, from the sea shore—which bear a strong resemblance to this species though I prefer to classify them with *I. javanica*, viz. Kloss 19136, For. Dept. B.N.B. 4037, 4256, 4276 (vide *I. javanica* var. *retinervia*).

On the type sheet of *I. Robinsonii* in the Singapore Herbarium there are two specimens, one each of the two form of flower-size. As Ridley described the corolla tube as 2" long, one should regard my 'Form 2' as the type. Ridley's statement that the corolla has 5 lobes is erroneous.

Our collection are yet too few to say if the species is as variable in size of flower as the other red *Ixoras*.

### ***I. Scortechinii* King et Gamble**

Dwarf Red *Ixora*

Mat. Fl. Mal. Pen. IV, 1904, p. 154.

Synonyms:—

*I. humilis* K. & G., loc. cit. non *I. humilis* O. Kze (1891).

*I. Kingiana* Craib, Fl. Siam. Enum. II, 1934, p. 159.

*I. humilis* var. *Scortechinii* Ridley, Fl. Mal. Pen. II, 1923, p. 95.

A dwarf, evergreen, little-branched or unbranched shrub up to  $\frac{1}{2}$  m. high, the stem sometimes decumbent with a few upright branches: leaves tufted at the top of the stem with the internodes more or less concealed by the overlapping leaf-bases.

Leaf-blade 13–36  $\times$  5–18 cm., elliptic to obovate, simply pointed or subacute, generally rather blunt, narrowed to the widely or narrowly cordate base, generally subsessile, broadest at or above the middle, dull green: lateral veins 11–21 pairs, passing obliquely forward and distinctly inarching near the margin: petiole 0–5 mm. long, generally concealed by the cordate leaf-base: stipular point 1–5 mm. long.

Corymb 4–9 cm. wide, terminal, subsessile, very dense, with red branches: sepals subacute: corolla-tube 2–4.5 cm. long: corolla-limb 1–2.75 cm. wide, the petals .5–.85 cm. wide, broad, rounded, blunt, pinkish yellow or orange pink generally deepening to brick-red.

Distribution:—Malaya (Pahang, Perak, Trengganu, Kelantan, Penang, Province Wellesley).

Syntypes:—As given by King and Gamble.

### **var. *caulescens* var. nov.**

A typo differt caule evoluto, usque 2 $\frac{1}{4}$  m. alto, internodis distinctis, corymbis terminalibus vel lateralibus longe pedunculatis (pedunculis 4–10 cm. longis) haud congestis.

Distribution:—Malaya, Lower Siam, (Selangor to Patani).

Typus: Hume 7940 (Selangor, Semyih, 13.7.21).

King and Gamble distinguished two species on the basis of the number of primary lateral veins to the leaf, namely *I. humilis* (15–18 pairs) and *I. Scortechinii* (8–12 pairs). I find that some collections have 11–16 prs. of veins, and others have 11–21. I have also seen plants with 11–14 prs. of veins on small leaves and 16–21 pairs on large leaves. But in no case have I seen as few as 8. King and Gamble referred, moreover, Curtis 400 and Wray 4157 to both species. The distinction seems to me inconsistent and therefore I have reduced both species, following Ridley, but have been obliged to re-install the binomial *I. Scortechinii* as the earliest legitimate name. Accordingly, Craib's later binomial *I. Kingiana* becomes a synonym.

Craib has given Penang as the type-locality of *I. humilis* K. & G., but these authors indicated no type, having cited six collections which must be taken as syntypes. Likewise there is no holotype of *I. Scortechinii* but 5 syntypes. Of the syntypes of *I. humilis* K. & G. I remove one (Ridley 7422a) to my variety *caulescens*.

This variety *caulescens* is abundantly distinct both in the herbarium and the field. It has the habit of a slender plant of *I. congesta* but the cordate, subsessile leaves and broad blunt petals of *I. Scortechinii*. There can be no doubt that *I. Scortechinii* is closely related to *I. congesta*, perhaps even derived directly from it, and therefore var. *caulescens* appears to retain its ancestral habit while typical *I. Scortechinii* has declined into a dwarf. The distribution of *I. Scortechinii* is curiously limited to the northern half of Malaya and that of var. *caulescens* scarcely exceeds it.

*I. Scortechinii* inhabits the dense, lowland forest. It is in cultivation at Singapore, where it makes a good front to a shady path or rockery, but it will not tolerate the open. In the size of the flower, perhaps also in the colouring, it is as variable as the other red-flowered species *I. congesta*, *I. javanica* and *I. Lobbi*.

#### KEY TO THE VARIETIES AND FORMS OF *I. SCORTECHINII*

Stem up to $\frac{1}{2}$ m. high, leaves crowded at the top:	
corymbs sessile .. ..	<i>I. Scortechinii</i>
Corolla-tube 2–2.5 cm. long	
Limb 1–1.3 cm. wide: petals .5 cm. wide ..	Form 1
Corolla-tube 2–3.8 cm. long	
Tube 2–3 cm. long: limb 1.3–1.6 cm. wide:	
petals .5–.65 cm. wide .. ..	Form 2
Tube 3–3.8 cm. long: limb 1.8–2 cm. wide:	
petals .6–.75 cm. wide .. ..	Form 3
Corolla-tube 3.8–4.5 cm. long	
Limb 1.8–2 cm. wide: petals .5–.65 cm. wide	Form 4
Stem 1–2 $\frac{1}{4}$ m. high, with distinct internodes:	
corymbs with peduncles 4–10 cm. long ..	var. <i>caulescens</i>

Corolla-tube 3.2-3.8 cm. long	
Limb 1.5-1.8 cm. wide: petals 5-6 cm. wide	Form 5
Limb 2-2.3 cm. wide: petals 6-9 cm. wide	Form 6
Limb 2.3-2.8 cm. wide: petals 6-9 cm. wide	Form 7
Corolla-tube 3.8-4.5 cm. wide	
Limb 2.3-2.8 cm. wide: petals 7-1 cm. wide	Form 8
Limb 1.8-2 cm. wide: petals 5-6.5 cm. wide	Form 9

## Collections

*I. Scortechinii* (typical)

## Form 1

Penang; Curtis s.n.: Perak, Wray 4157 (syntype).

## Form 2

Penang; Curtis 400 (syntype): Province Wellesley, Burkill 6596.

## Form 3

Perak; Ridley 7186 (syntype): Pahang; Burn Murdoch 215 (21.6.13): Kemaman; Corner s.n. (cult. Hort. Bot. Sing: flowers becoming pinkish orange, never red).

## Form 4

Trengganu: Corner 25836 (the flowers of this form appear to be persistently orange pink).

Specimens without flowers:—Province Wellesley; W. Fox's Collector s.n., Ridley 6992 (syntype): Pahang; Henderson 25081.

var. *caulescens*

## Form 5

Pahang; For. Dept. Mal. Pen. 20364: Selangor, Ridley 8234.

## Form 6

Selangor; Ridley 7422a (syntype of *I. humilis* K. & G.).

## Form 7

Selangor; Ridley 7422, Hume 7770A, 7940 (type).

## Form 8

Patani; Machado s.n. Sept. 1893.

## Form 9

Kelantan; Henderson 19518.

Specimens without flowers:—Kelantan; Haniff and Nur 10110, Henderson 29660: Perak; Corner s.n. 22.8.37.

**I. umbellata** Koorders et Valetton Malayan White Ixora

Bijdr. Booms. Java 8, 1902, p. 162.

Baumart. Java, IV, t. 550.

lc. Bog. II, t. 183.

Bot. Mag. t. 8577.

## Synonyms:—

? *Pavetta Korthalsiana* Miq., Ann. Mus. Lugd. Bat. 4, 1868-9, p. 197.

*I. Korthalsiana* (Miq.) Boerl., Hand. Fl. Ned. Ind. 2, 1891, p. 135.

non *I. Korthalsiana* Kurz, Journ. As. Soc. Bengal 46 (ii), 1877, p. 149. (= *Pavetta calycina* Korth. non *I. calycina* Thw.).

A shrub or treelet up to 6 m. high, glabrous except for the puberulous branches of the inflorescence, the hairy corolla-mouth and the puberulous corolla-tube: twigs pale.

Leaf-blade 13-33 × 5-13 cm., elliptic, acuminate or simply pointed, occasionally subacute, narrowed gradually to the base, drying light greenish: side-veins 12-20 pairs, not inarching or only vaguely with reticulations, the secondary veins coarsely

and conspicuously reticulate in the dried leaves: petiole 6–20 mm. long, rather stout: stipular point 1–4 mm. long.

Corymb 8–17 cm. wide, almost sessile or with a peduncle up to 4.5 cm. long, the branches articulate, puberulous and slender (1–2 mm. wide): bracts 3–7  $\times$  1.5–2.5 mm., linear lanceolate, green, narrowly leafy with minutely ciliate edge: bracteoles and sepals 3–6  $\times$  1.5–3 mm. long, oblong, obtuse or subacute, minutely ciliate on the edge, green, like tiny leaves, the sepals unequal: flowers white, fragrant: corolla-tube 2.5–4 cm. long, white, puberulous externally, the mouth sparsely to thickly bearded with white hairs: petals 6–10  $\times$  3–5 mm., white, oblong-elliptic, obtuse: anthers yellow: style green: bracts, bracteoles and, generally, the sepals caducous in the infructescence.

Distribution:—Malaya, Borneo, Java, ?Sumatra.

Type:—Hallier 719 (Java).

Collections:—

Perlis; Henderson 23027 (det. *I. crassifolia*), Ridley 14999a (det. *I. multibracteata*).

Kelantan; Henderson 19615 (det. *I. Kingstonii*).

Perak; Wray 3953 (det. *I. multibracteata*).

Pahang; Burkill 996 (det. *I. multibracteata*), Corner s.n. 11.6.32 (Pulau Tioman), Henderson 21677 (det. *I. multibracteata*), Nur 18754 (det. *I. multibracteata*).

Selangor; Kloss s.n. Feb. 1912 (det. *I. Kingstonii*) Ridley 8570, s.n. July 1897 (Gua Batu).

Johore; Corner 28489 (det. *I. Kingstonii*), 30685, Henderson 18219 (det. *I. multibracteata*), Ridley 12199 (det. *I. Kingstonii*).

Singapore; Ridley 15463.

Borneo; Mondy 219 (Karimata Archip.) (det. *I. Korthalsiana* Val.), Hallier 381 (det. *I. Korthalsiana* Val. and *I. umbellata*).

In the Eastern half of Malaya, this species is rather common by streams in the lowland forest. I have found it abundant in the sandy coastal woods in the East of Johore. The Malayan specimens have been identified mostly with *I. multibracteata* which I consider a distinct variety with larger bracts and sepals. Though I have not seen the type of *I. umbellata*, the original description and the three illustrations leave no doubt of the identity of the Malayan specimens. The white fragrant flowers, the large green leafy sepals and bracts, and the many-veined rather large leaves together characterise the species. It has been generally supposed related to *I. congesta* but the resemblance is superficial and suggests how little the genus can be interpreted from the herbarium.

Concerning *P. Korthalsiana* I am uncertain because there is no figure or recent description of it, though both Bornean specimens which I have cited were identified with it by Valetton.

The corolla tube and petals are very variable in length in different collections, so that it is impossible to define the species narrowly on flower-size.

var. **multibracteata** var. nov.Lesser Malayan White *Ixora*

Synonym:—

*I. multibracteata* King and Gamble, Mat. Fl. Mal. Pen. 4, 1904, p. 148.

Leaf-blade rather smaller and narrower (? always)  $8-30 \times 3-10$  cm., narrowed gradually to each end, the apex not acuminate, often subcoriaceous, dark glossy green with wavy edge: *side-veins* 10-15 pairs, generally fewer, the reticulations often faint: *petiole* up to 1.5 cm. long.

Peduncle of corymb up to 2.5 cm. long: *bracts*, *bracteoles* and *sepals* larger: *bracts*  $8-12 \times 5-10$  mm., *ovate*, shortly acuminate or acute: *bracteoles* and *sepals*  $6-12 \times 4-7$  mm.: *corolla-tube* 2.5-3.5 cm. long, *glabrous* or *sparsely puberulous* outside, the mouth *glabrous* or *hairy*.

Distribution:—L. Siam, North Malaya.

Syntypes:—As enumerated by King and Gamble.

Collections:—

Siam; Curtis 2954 (syntype).

Kedah; Curtis 3408 (syntype), Ridley 5540 (syntype), 15887.

Perlis; Henderson 23049, Ridley 14999.

Perak; Corner 31640, Wray 3317 (syntype).

The larger bracts and sepals distinguish this variety from typical *I. umbellata*. The difference is at first so striking that no doubt it led King and Gamble to overlook the resemblance of their species to Valetton's. Nevertheless the difference is barely double the linear dimensions of the parts, and little more than one finds in the variation of the size of the corolla, or of the sepals, in other species such as *I. concinna* and *I. Lobbii*, though in these, the sepals being much smaller, the variation is almost microscopic. Moreover fruiting specimens, from which the bracts and sepals have been shed, can be distinguished from those of typical *I. umbellata* only by a close comparison of the venation which reveals slight differences between the two which cannot be rendered in words: and, even so, I doubt if anyone could infallibly distinguish such.

Whether this variety is wide-spread in Malaya has still to be discovered. I have seen it only in villages where it is rather frequent from Ipoh northwards. Mr. J. N. Milsum informs me, however, that it occurs wild in the forest on the road to Grik.

***I. undulata* Roxb.**

Fl. Ind. I, 1820, p. 395.

This species is recorded as occurring in Malaya both by King and Ridley. The record is based on the collection, Wray 3934, which is *I. micrantha*, as I have shown under that species. There is no evidence that *I. undulata* is wild in Malaya.

***Ixora Sunkist* nom. hort. nov.**

A dwarf bush up to 1 m. high, glabrous, flowering throughout the year.

*Leaf-blade* 1.7-8 × .7-2.5 cm., small, subsessile, lanceolate elliptic to lanceolate obovate, acute or subacute, the base gradually or rather suddenly narrowed, subcoriaceous, rather dull and yellowish green; side-veins 6-13 pairs, directed obliquely forward and distinctly inarching near the edge: *petiole* .1-3 cm. long: *stipule-point* .1-3 cm. long.

*Corymb* 5-10 cm. wide, as in *I. chinensis*, the branches red: *sepals* as in *I. chinensis*, blunt to subacute: *corolla-tube* 2.2-3.3 cm. long, the limb 1.3-2.5 cm. wide, the *petals* .2-3 cm. wide, lanceolate acute or subacute, pinkish apricot-yellow turning brick red.

This description is based on specimens cultivated in Malaya, probably introduced from southern China, but their origin is unrecorded. They do not match any description I have seen. Pending a decision on their botanical status, I give to them the fancy garden name *Sunkist*. They grow best in the full sun and the round inflorescences are not unlike oranges in shape and colour. I find that there are two forms:—

1. leaves with 6-9 pairs of side-veins: *corolla-tube* 2.2-2.5 cm. long, the limb 1.3-1.6 cm. wide.

2. leaves with 8-13 pairs of side-veins: *corolla-tube* 3-3.3 cm. long, the limb 2-2.5 cm. wide.

As I have remarked under *I. chinensis*, this *Ixora* is what one imagines a hybrid of *I. chinensis* and *I. javanica* or *I. Lobbi* would be like. It has the foliage of *I. chinensis* and pointed petals of *I. coccinea*.

**SUMMARY**

The following new varieties of *Ixora* are described:—

*I. coccinea* var. *decolorans*, var. *aureo-rosea*, and var. *rosea*.

*I. grandifolia* var. *lanceifolia*.

*I. javanica* var. *multinervia*, var. *paucinervia*, and var. *retinervia*.

*I. Lobbi* var. *stenophylla*.

*I. Scortechinii* var. *caulescens*.

*I. umbellata* var. *multibracteata*.

"*Ixora Sunkist*" (a horticultural name).

## PALMAE MALESICAE

IX.—TWO NEW CORYPHACEOUS GENERA  
IN MALAYA

By C. X. FURTADO,  
*Botanic Gardens, Singapore*

## 1. General Remarks

While arranging, in the Singapore Herbarium, the specimens of the Malayan palms having fan-shaped leaves, I detected many anomalous characters in the specimens referred to *Livistona rupicola* Ridl. The petiole is not prolonged as a thick rachis into the lamina but ends in numerous, almost equal, primary ribs or costae of the lamina. Further the spadices or flowers are usually unisexual, the segments of the perianth are imbricate, and the three carpels of the ovary are free almost to the base and are provided with free styles.

These characters are sufficient to remove the specimens from the section to which the genera *Licuala* and *Livistona* belong and place them in a different section together with *Trachycarpus* and *Chamaerops*. The genus *Trachycarpus* is not recorded from any tropical regions, it being confined to sub-temperate regions from N. W. Himalaya to Tibet, Assam, Burma, Indo-China, China and Japan. It is closely allied to *Chamaerops*, which is confined entirely to the Mediterranean countries as far as Persia, and with which *Trachycarpus* is sometimes united. However BECCARI (Ann. Roy. Bot. Gard. Calc., XIII, 1933, pp. 7, 253 & 272) has shown that *Chamaerops* has ruminant seeds, and *Trachycarpus* non-ruminant ones grooved on the raphal side with a more or less deep intrusion of the integument. The Singapore specimens referred to *L. rupicola* have no mature fruits, but the seeds of the very young fruits present seem to agree with the description of the fruits of *Trachycarpus*. However the flowers exhibit details on which the specimens can be arranged into two definite groups, neither of which belong to *Trachycarpus* or *Chamaerops*.

The specimens in the first group are all from the limestone hills in the Langkawi Islands and have their stamens united into a conspicuous epigynous cup as in *Licuala*, whereas in *Chamaerops* the stamens are united into a small hypogynous cup and in *Trachycarpus* they are entirely free. These Langkawi specimens are made here the basis of a new genus *Liberbaileya* named in honour of the American palm specialist Prof. L. H. BAILEY. Its type species has been named here as *L. lankawiensis* Furtado to show the exact area where it is native. The imbricate perianth and the staminal cup would make the genus a close ally of the American palm genus *Acanthorhiza*.

The specimens of the second group are from the limestone hills in Selangor and are referred here to a new genus *Maxburretia*, named in honour of the European palm specialist Prof. M. BURRET. These specimens are generically distinguished from *Liberbaileya* by their stamens being epipetalous; and were it not for their free styles and imbricate perianth, *Maxburretia* would have been a close ally of *Livistona* and *Rhapis*. The type species of this new genus is *M. rupicola* (Ridl.) Furtado (*Livistona rupicola* Ridl. *emend.* Furtado). The generic description is derived not from the lectotype of *M. rupicola*, but from its apotype, NUR 34370.

*Liberbaileya lankawiensis* is a caespitose palm producing, under favourable conditions, a stem 10 ft. high. Its leaf-blade is small, about 1-1½ ft. in diameter and bears, as in some varieties of *Chamaerops humilis*, small punctiform brown marks all over in the lower surface. The flowers are arranged in groups of 3-5 on a simple spadix which bears two or three spathe in the peduncular parts and many, scattered, simple or divided flower-bearing branchlets at the apex. On the other hand, *Maxburretia rupicola* is apparently a stemless or scarcely caulescent, solitary palm; it produces larger leaves with no brown marks in their lower surface, compound spadices with 4-6 partial inflorescences, and one separate spathe at each internode, and usually solitary flowers (rarely in groups).

Both these species have unarmed petioles, thus differing from both *Chamaerops* and *Trachycarpus* and resembling the American genera *Trithrinax* and *Acanthorhiza*. The spadices in both these new genera appear to be dioecious, though traces of polygamous spadices have also been observed.

Since both these genera are confined only to the limestone hills in the Peninsula and have no allies in its immediate neighbourhood, it is reasonable to suppose that they are vestiges of an ancient flora of the Peninsula; and since the nearest allies are in America, in the sub-temperate regions of Asia and in the Mediterranean countries, it seems reasonable also to suppose these two Malayan genera are immediate descendents of a stock that existed somewhere at the Cretaceous period and that gave rise also to *Chamaerops*, *Trachycarpus*, *Acanthorhiza*, etc.

The fact that in some cases open limestone vegetation produces conditions favourable for the growth of plants of colder or seasonal climates or of higher altitudes (cf. KRASAN in Engl., Bot. Jahrb. II, 1882, pp. 240 & 249-250; VAN STEENIS in Bull. Jard. Bot. Buitenz. XIII, 1935, p. 296) might account for the persistence of these two genera in the Peninsula only on the limestone hills. This hypothesis would also explain why HENDERSON (Journ. As. Soc. Malayan Br. XVII, 1939; pp. 13-87) found that almost all

the genera occurring in the peninsular limestones, if not common in the Peninsula, represented the southernmost extension of the range of the genera found in the north of the Peninsula as in Thailand, Burma and Indo-China. On the other hand, the absence of these two palm genera or their very close allies in the countries lying immediately to the north of the Peninsula might be more apparent than real, for botanically these regions are very imperfectly known, especially as regards the occurrence and the distribution of palms; further explorations may reveal in the area the existence of these two new genera or their close allies.

However, there are cases, though very rare, where genera or species occur in the Peninsula only on the limestone hills and in distant temperate and sub-temperate climates but not in other parts of the Peninsula or in countries lying in the immediate neighbourhood of the Peninsula. Thus the genus *Pistacia* (ANACARDIACEAE) which has a wide distribution from the mountains of Luzon and Formosa to China, westwards to Yunnan, Upper Burma, Himalayas, Afghanistan, the Mediterranean region, and the Canaries in the Old World and in Texas and Mexico in the New World, is represented by *Pistacia malayana* on the limestone hills of Selangor and Upper Perak in the Peninsula, though the genus has so far not been recorded either from Lower Burma, Thailand and Indo-China, or from the northern parts of the Peninsula.

## 2. Systematic Notes

### A. *Liberbaileya* Furtado gen. nov. (CORYPHIOIDEAE)

*Palmae* nanac, dioecae vel polygamae, caespitosae vel solitariae. *Petiolii* inermes, apice in costas aequicrassas vel fere in lamina producti. *Laminae* frondium flabelliformes. *Spadices* interfoliales, simplices (semper?); flores unisexuales vel hermaphroditi. *Sepala* imbricata; calyx brevior quam corolla. *Stamina* 6, in annulum conspicuum unita ut in LICUALA. *Carpella* 3, libera. *Fructus* erectus, semine aequabile (?).

#### 1. *Liberbaileya lankawiensis* Furtado sp. nov.

*Caulis* humilis, ad 3 m altus, caespitosus vel non, inferne annulatus superne infra coronam foliarum vaginibus fibrosis caulem amplexantibus, nigris, tectus. *Petiolus* inermis, metralis, semiteres, utrinsecus angulatus, apice ut rachis haud productus, sed in uno latere in ligulam parvam et in altero latere in costas aequicrassas vel fere terminatus. *Lamina* frondis 25–40 cm. longa,  $\frac{3}{4}$ -orbicularis basi cordata, subtus glaucescens fusco punctulata, junior  $\frac{1}{2}$ -orbicularis basi cuneata; segmentis 25–30, unicostulatis, apice cuneatis-simis, acutis, pungentibus vel breviter bifidis, basi ad 5–12 cm. connatis. *Spadix* gracilis, unisexualis vel polygamus,



Fig 1 *Liberbaileya lankawiensis* (Holotypus HRN)

a. Lolium cum parte petioli super  
integer c Fructus juvenilis d  
tium verticaliter dissectum f.  
tepala resecta ut aestivatu

simplex, circa 80 cm. longus, inferne ad 50 cm. pedicelliformis, cum spathis 2-3 bicarinatis, tubulosis, gramineis, plus minusve striatis apice oblique truncatis, acutis vel bifidis involutus, et interdum infra partem ramosam 1-2 bracteolos liguliformes vel lineares ferens; superne in ramos remotos simplices vel ramulosos primo dense pubescentes tarde puberulos vel glabros, plerumque in axilla bracteoli orientes terminatus. *Flores* feminei, vel interdum hermaphroditi, oblongi, 2 mm. longi, 12 mm. crassi, in glomerulos distantes spiraliter dispositos 3-5 aggregati; flores masculi ignoti. *Calyx* circa 08 mm. longi, glaber, rugosus sepalis late ovato-reniformibus, imbricatis. *Corolla* calyce duplo vel triplo longior, glabra, striata, petalis oblongis, imbricatis. *Stamina* vel staminodia 6, in annulum membranaceum conspicue unita. *Carpella* 3, ventricosa, dense pubescentia, libera, in stigma glabrum abrupte terminata. *Fructus* juvenilis tantum visus, erectus, vestigio stylare apicale vel paulo excentrico; semen aequabile(?).

MALAY PENINSULA: *Langkawi*, Pulau Dayang Bunting in collina calcarea (Henderson, 29134, Holotypus; Curtis, 2661, vern. nom. Serdang Batu); loc. incert. (Fox in Dec. 1904).

Hermaphrodite flowers which are also seen in this species resemble the female flowers. The fruits are too young for an investigation into the nature of the albumen, the position of the embryo, etc.; in the shape and arrangement of the perianth and of the young developing ovaries this species appears to be like *Maxburretia rupicola*.

CURTIS mentions that the stems reach a height of 6-10 ft., and HENDERSON notes that they attain about 10 ft. amongst dry rocks, but that the plants are dwarfed when growing in cracks of the rocks near the sea. That the palm is caespitose has not been recorded by any of the collectors; but I have noticed this character in a plant growing in the Botanic Gardens, Singapore.

#### B. *Maxburretia* Furtado gen. nov. (CORYPHOIDEAE)

*Palmae* dioeciae, nanae vel acaulescentes. *Petioles* inermes, apice in costas aequicrassas in lamina producti. *Laminae* frondis flabelliformes. *Spadix* interfoliaris, unisexualis, in inflorescentias partiales divisus; flores solitarii vel glomerati. *Tepala* imbricata; calyx brevior quam corolla. *Stamina* 6, epipetala. *Carpella* 3, libera. *Fructus* erectus; semine erecto; albumine aequabile; intrusione integumentali brevi, ad latus raphale sito.

Specimen typicum NUR 34370.

*Maxburretia rupicola* (Ridl.) Furtado comb. nov.

*Maxburretia rupicola* in Journ. Asiat. Soc. Straits  
(1903) 41 et Mat. Fl. Malayan Pen., Monocot.,  
-tim; Becc. in Webbia V (1921) 16 et 20

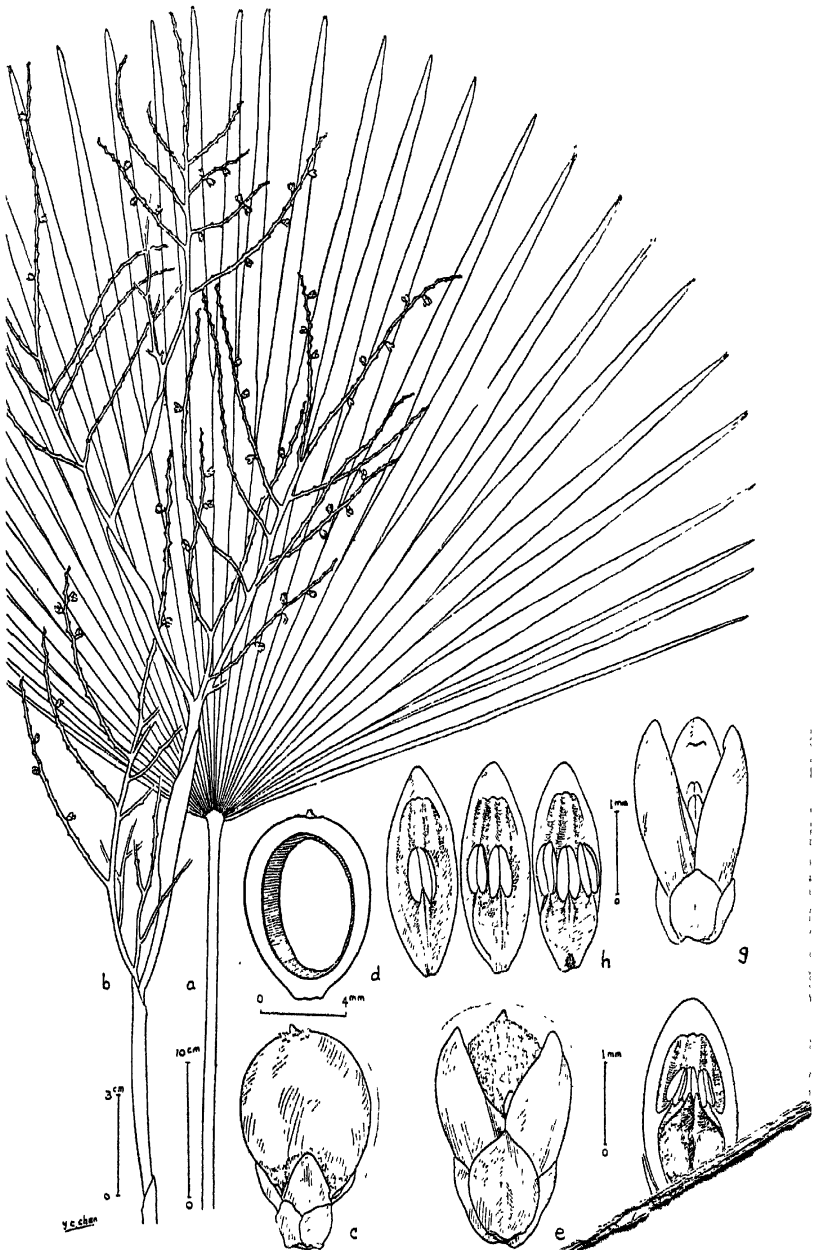


Fig. 2. *Maxburretia rupicola* (Apotypus: NUR 34370).

a. Folium cum parte petioli superioris  
feminei. c. Fructus juvenilis. d. Longitudinalis  
cissus ut albumen integumentum  
femineus post anthesin. e. Longitudinalis  
g. Alabastrum. h. Petala.

(§ LIVISTONELLA); Ridl., Fl. Malay Pen. V (1925) 23 p.p.; Becc. in Calc. Annals XIII (1933) 105 t. 53 (§ LIVISTONELLA); Henderson in Journ. Roy. Asiat. Soc. Malayan Br. XVII (1939) 85 p.p. (ex altera parte = *Liberbaileya lankawiensis*).

*Planta* nana, vel acaulescens, solitaria (semper?). dioecia. *Petiolus* metralis, semiteres, inermis, postice convexo planus, untrinsecus angulatus, apice in costas fere aequicrassas in lamina percurrentes, basi vagina fibrosa, brunneo-nigrescente, liguliforme, 10–20 cm. longa, caulem amplectante, in senectute in fibras persistentes soluta. *Lamina* frondis 50–60 cm. longa, flabelliformis,  $\frac{1}{3}$ -orbicularis, subtus albescens, basi cuneata, apice in lacinias acutas 12–18 cm. longas, aut 30–35 uncostulatas 2 cm. latas, apice bifidas, aut pauciores, latiores, 2–4 costulatas, apice totidas quot costulas. *Spadix* unisexualis, 45–60 cm. longus, masculus femineo longior, in 4–6 inflorescentias partiales, pubescentes, masculas femineis ramosiores, divisus. *Spathae* brunneae, glabrae, valde striatae, acutae, vel acuminatae, interdum bifidae. *Flores* solitarii, rarissime 2–3 glomerati, spiraliter dispositi; masculi circa 2.5 mm. longi, lineares vel obovato-oblongi, 0.8–1 mm. crassi; feminei ovato-oblongi paulo minores masculis. *Calyx* circa 0.8 mm. longus; sepala imbricata, ovata, acuta, rugosa. *Corolla* calyce triplo longior; petala striata, imbricata. *Stamina* 6, petalis paulo breviora, epipetala, filamentis subulatis, antheris cordatis. *Staminodia* petalis valde minora, 6. *Carpella* 3, valde ventricosa, fusiformia, dense sericea, 1–3 fertilia, singula in stylum conicum liberum glabrum subito contracta; stigmatibus punctiforme. *Carpellodia* minuta, glabra. *Fructus* juvenilis tantum visus, glaber, erectus, obovato-oblongus; semine erecto; albumine aequabile; intrusione integumentali breve; embryone non viso; vestigio stylare apicale vel paulo excentrico.

MALAY PENINSULA: *Selangor* (Gua Batu, Ridley 8285, Lectotypus); Batu Takun prope Kanching (Nur, 34370, Apotypus).

RIDLEY notes that this produces a stem about 3 ft. high and 6 inches through; but NUR informs me that he found it always stemless and solitary. The situation of NUR's collection was steep, exposed limestone rocks where the vegetation usually makes a poor growth.

The basynym, *L. rupicola*, was based on two specimens, one collected at Gua Batu by RIDLEY and the other in the Langkawi Islands by CURTIS. As the two specimens represent two distinct species, and as the Gua Batu one appears to have been the principal basis of the description, RIDLEY, I have typified the species on the last one, making the other specimen the paratype *lankawiensis*.

The leaf in RIDLEY 8285 contains 2-4 costulate segments: and since this was unusual in the genus *Livistona* except in juvenile stages, BECCARI employed the character to create the section *LIVISTONELLA* under *Livistona*. But the many stages represented in NUR's collection lead me to conclude that the degree of leaf division in RIDLEY 8285 represents that of young plants.

There are no flowers in the lectotype preserved in Singapore, a reason why BECCARI failed to discover the erroneous generic identity made of the specimen by RIDLEY. However NUR 34370 has supplied the important diagnostic characters lacking in RIDLEY 8285, for which reason NUR's specimen has been called here the Apotype of the species (for the definitions of the nomenclature of types, *see* FURTADO in Gard. Bull. Straits Settl. IX, 1937. pp. 285-309).

## ALOCASIA MACRORRHIZA AND ITS VARIETIES

By C. X. FURTADO,

*Botanic Gardens, Singapore*

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## 1. Introduction

The binomial *Alocasia macrorrhiza* has been used in more than one sense. Some of the plants which have passed under this name are economically very important and found in cultivation or as escapes in the tropics of both hemispheres; others are of little economic value and not known in cultivation or as escapes except in their native country and perhaps in some botanic gardens. Further, many experiments and analyses have been made in order to test their value as food to men and animals, and the results have been sometimes conflicting. The existence of many varieties in some of the species called by this name is also a factor that has caused further ambiguity. The present paper is an attempt towards the clarification of this ambiguity.

It is my pleasant duty to record here my thanks to Dr. R. C. BAKHUIZEN VAN DEN BRINK, Agricultural Department, Buitenzorg, Dr. G. J. A. TERRA, Horticultural Division, Batavia, Dr. C. G. G. J. VAN STEENIS, Botanic Gardens and Herbarium, Buitenzorg, Dr. K. BISWAS, Royal Botanic Gardens, Calcutta, and Mr. E. F. ALLEN, Agricultural Department, Teluk Anson, Perak, for procuring for me planting material of the species and varieties connected with the nomenclatural problems of *Alocasia macrorrhiza* and its varieties; without this material it would have been impossible for me to clear many difficulties discussed in this paper.

## 2. The Authorship of the Name

The genus *Alocasia* was published first by NECKER, *Elem. Bot.* III (1791 p. 289), a work proposed for rejection by some botanists (see FURTADO, 1937, p. 252 footnote).

*Gardens Bulletin, S.S.*

But whether by rejecting this we should also reject *A. macrorrhiza* (L) Sweet and *A. cucullata* (Lour.) Sweet I have not been able to investigate; both these names have been recorded with their respective basynyms in STEUDEL'S Nomenclator Botanicus ed. 2, vol. I (1810), though the authorities so far consulted by me attribute these combinations to SCHOTT (1851). No doubt in Index Kewensis these two combinations have been recorded as if they were published by SCHOTT et ENDLICHER in their Meletemata I (1832 p. 18); but this is an error, for there *Alocasia* was accepted only as a section of *Colocasia*. Since NECKER'S work is not yet rejected, I propose in this treatment to follow STEUDEL and cite the name as *Alocasia macrorrhiza* (L) Sweet.

### 3. The Typification of the Species

*Alocasia macrorrhiza* (L) Sweet is an isonym derived from *Arum macrorrhizon*, a binomial coined by LINNAEUS in Species Plantarum ed. 1 (1753, p. 965) for a species from Ceylon. The specific prologue<sup>1</sup> given by LINNAEUS runs as follows:—

“*Arum acaule, foliis peltatis cordatis repandis: basi bipartitis: Fl. Zeyl. 327. Roy. lugdb. 7[?6].*

*Arum maximum macrorrhizon zeylanicum Herm. par. 73 t. 73. Raj. Suppl. 571.*

*Habitat in Zeylona, perennis.”*

I have not been able to consult the last reference given by LINNAEUS. In the second reference the number “7” appears to be a misprint of “6”, but in neither of these references (6 or 7) are the leaves described as peltate. In the third reference (Herm. Parad. Bat. p. 73, t. 73), the species is described and depicted with sagittate leaves. In Flora Zeylanica (the first reference given by LINNAEUS), reference is made to ROYEN'S (the second reference) and HERMANN'S (the third reference) species, but the plant is described as peltate-leaved.

I have not been able to consult two more books cited under the species in Flora Zeylanica, and so I do not know whether these references refer to any peltate-leaved species. However, there is evidence to show that the Linnean phrase “*foliis peltatis, basi bipartitis*” refers to sagittate leaves in the modern sense. Thus the sixth *Arum* in Hort. Cliff. p. 135, which is said in Flora Zeylanica to have the same appearance as *Arum macrorrhizon*, is described as having “*foliis peltatis, ovatis, basi bipartitis*”, a description subsequently expanded to mean “*modo latus foliis a petiolo*

<sup>1</sup> A PROLOGUE is the printed matter (description, etc.) accompanying the original publication of a name or epithet.—A. J. WILMSON in Journ. Bot [London] LXXVII (1939) 206.

ad basin totum bipartitum" (RICHTER, 1840). LINNAEUS also described his *Arum peregrinum* in Hort. Cliff., p. 435, No. 7, as having leaves "folia peltata, cordata usque ad petiolum"; *Arum peregrinum* L. is an accepted synonym of *Alocasia macrorrhiza*.

The other alternative is to assume that LINNAEUS confused a species of *Colocasia* with *Alocasia macrorrhiza*, overlooking the warning given by HERMANN (1698, p. 71) in the following observation under his *Arum maximum macrorrhizon zeylanicum*, t. 73:

"Idem *Arum* videtur quod COMELINUS in *Catal. Horti. Med. Amstel.* nominat *Arum maximum Ceylanicum radice crassa longa rotunda uncinulata Colocasiae folio. Welila Hort. Malab. part. 13* nondum editae. Ast appellatio isthaec non arridet, Nostri enim folia nihil cum *Colocasiis* habent commune, sed forma ad *Arum* accedunt, pediculumque cui incumbunt non in medio sed extremo foliorum insertum habent."

Welila or Weli-Ila in RHEEDE's Hort. Malab. XI, t. 22, is a special variety of *Colocasia esculenta* which produces long, thick, edible subterranean suckers, and it is possible for persons not acquainted with the plants to apply the description of the runners of this variety of *Colocasia* to the thick, edible, sometimes inclined, rhizomes of *Arum macrorrhizon* (quoad HERMANN'S plate).

But there is not the slightest evidence to support this view. On the contrary there are abundant reasons to justify the typification of *Arum macrorrhizon* on HERMANN'S plate 73: (1) *Arum macrorrhizon* has always been interpreted as a species of *Alocasia* and not of *Colocasia* (both genera in the modern sense); (2) "foliis peltatis, basi bipartitis" in Linnean sense probably means sagittate leaves with a somewhat acute sinus at base: (3) *Flora Zeylanica*, which supplied the definitive phrase cited under *Arum macrorrhizon* L., was based mainly on HERMANN'S herbarium (TRIMEN, 1887; BOULGER, 1900; ARDAGH, 1931; OOSTROOM, 1937); (4) HERMANN'S plate and description indicating an *Alocasia* with sagittate leaves was cited both in *Flora Zeylanica* and again independently in the prologue of *Arum macrorrhizon*; (5) the specific epithet *macrorrhizon* adapted by LINNAEUS was derived from HERMANN'S specific phrase-name quoted in the prologue of *A. macrorrhizon*; (6) there are no specimens of the species either in the Linnean herbarium in London (JACKSON, 1912), or in HERMANN'S collection in Leiden (OOSTROOM, 1937), and the drawing which exists in HERMANN'S herbarium in the British Museum, London, represents the same species as HERMANN'S plate; (7) the species depicted by HERMANN is a common species in Ceylon, specially in the lowlands. HERMANN made the bulk of his Ceylon collection

(TRIMEN, 1887; BOULGER, 1900); (8) no species of *Alocasia* having large peltate leaves has been discovered in Ceylon (PETCH, 1919; ALSTON, 1931).

#### 4. Splitting the Species

The particulars given by HERMANN (1698) concerning the vernacular name and economic uses coupled with the description and the plate led some early botanists to interpret *Arum macrorrhizon* L. in the sense indicated by the present typification. Thus G. FORSTER (1786 & 1786 bis) identified as *Arum macrorrhizon*, the sagittate-leaved *Alocasia* cultivated in Ceylon, New Zealand and Polynesia for its edible stems and depicted by RUMPHIUS as *Arum indicum sativum*, Herb. Amb. V (p. 306, t. 106) (FORSTER gave an erroneous description of the flowers). ROBERT BROWN (1810, p. 192) also cited *Arum macrorrhizon* L., *A. maximum macrorrhizon zeylanicum* Herm. Parad. 73, t. 73, and *A. indicum sativum* Rumph. Amb. V (p. 308, t. 106) under his *Calladium ? macrorrhizon*, observing at the same time that both HERMANN'S plate and RUMPHIUS'S plate (without the spadix) were good representations of the plant in question.

LOUREIRO (1790), who was working in Cochin-China with a small library at his disposal, was probably not able to consult HERMANN'S *Paradisus*, or any other books which identified *A. macrorrhizon* with the large sagittate-leaved *Alocasia* furnishing edible stems. The Linnean statement that *A. macrorrhizon* was stemless had raised difficulties even to LINNAEUS, who suggested the possibility of *Arum indicum sativum* Rumph. being a different species, *Arum arborescens* (cf. STICKMANN, 1751). LOUREIRO was also misled by the phrase "foliis peltatis" used by LINNAEUS in the prologue of *Arum macrorrhizon*. Consequently LOUREIRO identified with the last a stemless species, having peltate leaves and [practically?] no appendix to the spadix (probably *Colocasia gigantea*), and named as *Arum indicum* the sagittate-leaved species depicted in the Rumphian plate 106 and cultivated also in Cochin-China for its edible stems.

The name *Arum indicum* of LOUREIRO was adopted by ROXBURGH (1832) for an edible *Alocasia* cultivated in Bengal. ROXBURGH found some difficulties in identifying *A. macrorrhizon* owing perhaps to the statement in the prologue that the species was stemless; he was thus inclined at first to identify *A. macrorrhizon* with *A. montanum* Roxb. (see ROXBURGH'S remarks under the latter op. cit., p. 497).

Since ROXBURGH had described *Arum indicum* in detail<sup>1</sup> giving its vernacular names and economic uses, and since ROXBURGH'S drawing of the plant was later published

WIGHT (Ic. Pl. Ind. III, t. 794), the name *Arum indicum* and its isonym *Alocasia indica* became widely current in India for the plant cultivated in Bengal.

Since there were some discrepancies in the descriptions of *Arum indicum* Lour., *A. indicum* Lour. *sensu* Roxb. and *A. macrorrhizon* L., SCHOTT (1854) was inclined to consider these three descriptions as representing three distinct species. This view of SCHOTT was contested by KOCH (1854) who maintained that all these three represented but one single species. But SCHOTT's opinion, after his defence in pointing out the discrepancies (1855) and the revision of all the Aroids then known (1860), was followed by many botanists, notably ENGLER (1879) and later by ENGLER & KRAUSE (1920).

MIQUEL (1855) seemed to have agreed with KOCH in reducing *Arum indicum* Lour. *sensu* Roxb. to *Alocasia macrorrhiza*, but for some unaccountable reasons he also retained *Alocasia indica* with the synonym *Arum indicum* Lour. or Roxb. as the correct name for *Caladium giganteum* Bl.

PETCH (1919) pointed out that in Ceylon there is only one large-leaved species of *Alocasia* and that this should be called *A. macrorrhiza*, that specimens of this species from Ceylon were very rare in Europe, the only one he found being THUNBERG'S, and that the plants which pass in Ceylon as *A. indica* are cultivated species of *Xanthosoma*. ALSTON (1931) further pointed out that the only large-leaved *Alocasia* that occurs in Ceylon has sagittate leaves, that on geographical considerations the name *A. macrorrhiza* should be applied to this species, and that the real *A. indica* is probably a variety of *A. macrorrhiza*. ALSTON did not consider the problem either of the interpretation or of the typification of *A. macrorrhiza* on the original description of the species; nor did he consider whether *Arum odorum* Roxb. or *Caladium odorum* Roxb. *ex* Lindl. was a distinct species or not.

Perhaps influenced by the statements of ALSTON, MERRILL (1935), who had previously (1922) maintained *Alocasia indica* and *A. macrorrhiza* as specifically distinct, the former not occurring in the Philippines, considered *A. macrorrhiza*, *A. indica* and *Arum indicum* Lour., and *Arum indicum* Rumph. as representing the same species. He did not refer to the confusion of other species either with *A. indica* or with *A. macrorrhiza*.

##### 5. Confusion with *Alocasia odora*

There is an Aroid growing wild in Burma, Khasia, Jaina, etc. which has peltate leaves and which was described as *Arum odorum* by ROXBURGH (1832) and figured by

WIGHT (Jc. Pl. Ind. III, t. 797). This species was named by KOCH (1851) as *Alocasia odora* and by SCHOTT (1854) as *A. commutata*. It does not occur in Ceylon, Malaya, Polynesia, etc. either in cultivation or wild.

But ten years before the posthumous publication of the binomial by ROXBURGH (1832), LINDLEY (Bot. Reg., 1822, t. 611) published under *Caladium odorum* a Latin version of ROXBURGH's manuscript description of *Arum odorum* and a plate which in general aspects of the plant appears to correspond to *A. indicum* of ROXBURGH, though the inside of the spathe is depicted green. ENGLER (1879) and ENGLER & KRAUSE (1920) who keep *Arum macrorrhizon* L. and *A. odorum* Roxb. as two distinct species with *Alocasia macrorrhiza* and *A. odora* as the correct names, identified *Caladium odorum* Lindl. in Bot. Reg., t. 641, as *A. macrorrhiza* which normally produces a whitish or yellowish spathe-limb.

Since the drawing of the entire plant in LINDLEY's plate was made from the living plant, whereas the details of the spathe, spadix, flowers, etc. were drawn from the specimens communicated to LINDLEY, it might seem legitimate to suspect that the different colours in these detail figures were given in order to make them conform not with the colours of the material (which might have faded) but with the colours indicated by ROXBURGH'S description quoted. However, this explanation does not receive any support from the plate published of apparently the same species, by HOOKER in Bot. Mag., (1842), t. 3935, under the name of *Colocasia odorata*; in this plate the colour of the spathe agrees with that given by LINDLEY in Bot. Reg., t. 611. However, if the determination by ENGLER (1879) is correct, and ENGLER had examined practically all the available Aroid material in the great botanical institutions in England, it is possible that the peculiar colour variation is a product of the stove environment in which the plants are grown in Europe. The two plates are so poor that it is difficult to decide whether the identification made by ENGLER (1879) is right or not. There is, however, ample evidence to show that the name *A. odorum* and its isonyms were used from LINDLEY (1822) onwards in more than one sense, perhaps for any large-leaved *Alocasia* grown in hot-houses of Europe (cf. the synonymy given by ENGLER (1879) and ENGLER and KRAUSE (1920) under *Alocasia indica*, *A. macrorrhiza* and *A. odora*).

This indifferent use of the name *Arum odorum* and of its isonyms, and the misleading use of the word "peltate" by LINNAEUS in describing his *Arum macrorrhizon* must have led THWAITES (1864), TRIMEN (1885 & 1890), HOOKER (1893), RIDLEY (1907 & 1925), KOORDERS

HAINES (1924) and FISCHER (1931) either to describe *Alocasia macrorrhiza* as having peltate leaves or at least to reduce *Arum odorum* or *Alocasia odora* as its synonym, or to do both, and then maintain *A. indica* as a distinct species. The synonymy given by ENGLER (1879) and ENGLER & KRAUSE (1920) in order to show the different uses of *Arum odorum* or its isonyms was probably not understood because these authors failed to note that, though *Caladium odorum* Lindl., Bot. Reg. (1822), t. 641, quoad descriptionem was *Arum odorum* Roxb., *C. odorum* Lindl., Bot. Reg. (1822), t. 641, quoad tabulam was, in their opinion, a different plant identical with *A. macrorrhiza*.

HAINES (1924), who noted the differences given by ENGLER & KRAUSE (1920) between *A. macrorrhiza* and *A. odora* and who had opportunities to study *A. odora*, could not understand the distinction given by ENGLER & KRAUSE, chiefly because he failed to recognize that *A. macrorrhiza* sensu lato included the plants he described as *A. indica*. Hence HAINES'S remarks that, if one were to follow ENGLER & KRAUSE (1920), *A. macrorrhiza* should be used for Ceylon plants and *A. odora* for the Indian ones. ALSTON (1931), who pointed out certain discrepancies in the colour of the spathes of Bot. Reg. t. 641, and in those of the Ceylon plant, noted that the Ceylon plants referred to *A. macrorrhiza* have sagittate leaves and on geographical grounds appeared to be correctly named.

## 6. Confusion with Colocasia & Xanthosoma Species

In some parts of India, where *Alocasia odora* and *A. macrorrhiza* occurred, it was not difficult to use *A. macrorrhiza* for *A. odora*, and *A. indica* for *A. macrorrhiza*. But in Ceylon (PETCH, 1919; ALSTON, 1931) and in Malaya, where no *Alocasia* with a large rhizome and large peltate leaves occurs, the use of the two binomials, *A. macrorrhiza* and *A. indica*, would have been extremely difficult, had it not been for the fact that cultivated species of *Xanthosoma* were, owing perhaps to their edible tubers and large leaves, mistaken for Asiatic plants. Thus THWAITES (1861), TRIMEN (1885, 1898), WILLIS (1911) & PARSONS (1926) recorded *A. indica* for Ceylon as if it were an exotic plant existing only in cultivation, and made no mention of any *Xanthosoma* species which have been long in cultivation there. According to PETCH (1919) the vernacular names cited under *A. indica* by TRIMEN and others also suggest the cultivated *Xanthosoma* species of Ceylon. BARRETT (1910) also mentions his receiving *Xanthosoma* material from Singapore, Buitenzorg, etc., as *Alocasia indica*, *glia violacea*, *A. macrorrhiza* and *A. javanica*, or as

*Colocasia monorrhiza scriptum* and *Colocasia antiquorum niger*. And I have received *Xanthosoma* material from Calcutta as *Alocasia violacea* (a binomial usually reduced as a variety of *A. indica*).

Many factors must have contributed to allow this masquerade of *Xanthosoma* spp. as *A. indica* to pass undetected for so long. The basal sinus of the leaves of the edible *Xanthosoma* spp. cultivated in the East is wide, and since that of *A. macrorrhiza* is very narrow and was described in most books as peltate, it was easy to take the *Xanthosoma* species with a wide leaf sinus as fitting with the description given under *A. indica*. Besides *A. indica* is described as a large-leaved plant cultivated for its edible tubers or rhizomes, a description also applicable to the species of *Xanthosoma*. Further, owing to the large size of the leaves, herbarium specimens of these plants are usually very poor and are rarely made. Moreover the cultivated *Xanthosoma* species flower but rarely and without flowers it is not easy for systematists to identify the plants, the general tendency in such cases being to identify the plants on their vernacular names, economic uses, the country of origin, etc. (a procedure eminently suited for perpetuating the confusion if already made). In species of both these genera there are many forms, some with violet petioles. In fact BARRETT (1910) experienced such great difficulty in distinguishing, on sterile material, the species of *Xanthosoma* from those of *Alocasia* that he evolved a key based entirely on the openness of the leaf sinus, a key that, while enabling him to identify correctly the best kinds of *Xanthosoma* in cultivation, misled him to classify under *Alocasia* some inferior kinds of *Xanthosoma*.

Apparently the confusion existing in several botanical works coupled with the absence of a satisfactory key to enable one to distinguish generically between these plants on vegetative characters led OCHSE (1931) to record under *Colocasia esculenta* some information received by him concerning the uses and the vernacular names of the cultivated varieties of *Alocasia*, *Colocasia* and *Xanthosoma*, and also to suppress altogether any discussion on *Alocasia*, though *A. macrorrhiza* plays a very important role in the diet of the peoples of the Netherlands Indies, much more important than many other plants discussed in the book, e.g. *Schismatoglottis calyptriata*. MACMILLAN (1935) considered all edible species of *Alocasia* and *Xanthosoma* as if they were generically identical and depicted a species of *Xanthosoma* with "*Alocasia* (*Xanthosoma*) *indica* var." for its legend, though he was personally inclined to regard all these edible species of *Xanthosoma* and *Alocasia* varieties of *Colocasia esculenta*.

Such a confusion, very common in books written before the beginning of the twentieth century, has now decreased considerably, apparently due mainly to the writings of BARRETT (1910) and of ENGLER and KRAUSE (1920), who worked on many specimens derived from cultivated material in Asia and America and who quoted in some cases vernacular names.

## 7. Varieties

Some of the varieties here described are so distinct that it may be better to separate them as species or subspecies; however I have retained the varieties, firstly to show their affinities, secondly to warn systematists and agriculturists against the confusion so often made over these names, and thirdly to conform with current procedure. In horticulture all these varieties usually pass as species.

The varieties described below may be divided into two large groups: (1) one having the spathe very much longer than the enclosed spadices: vars. *typica* and *nigra*; and (2) the other having the spathes nearly as long as, or slightly longer than, the spadices: vars. *variegata*, *marmorata* (?), and *rubra*. There is a tendency to restrict the binomial *A. indica* to the second group because it includes *Aium indicum* Lour. sensu Roxb. (1832), but *Aium indicum* Lour. itself appears to be the typical *Alocasia macrorrhiza*. If the second group were separated specifically from *A. macrorrhiza*, then the status of *Aium cordifolium* Bory (1804), *Aium punctatum* Desf. (1829), etc. will have to be investigated as they seem to have a better claim than *Alocasia indica*, if this is typified on ROXBURGH's description.

1. *Alocasia macrorrhiza* (L.) Sweet in Steudel (1810) 56; Schott (1854) 109 and (1860) 146; Engler (1879) 502; Engler et Krause (1920) 81: cf. also Petch (1919), Alston (1931), Merrill (1935) and Furtado (1940).

*A. indica* (Lour.) Schott (1854) 110: cf. also Koch (1854), Schott (1860), Engler (1879), Hooker f. (1893), Engler et Krause (1920) and Ridley (1925).

*Aium indicum* Lour. (1790) 537 and Roxb. (1832) 198.

*Aium macrorrhizon* L. (1753) 965.

*Colocasia indica* (Lour.) Kunth, Enumer. III (1811) 39; Hassk. in Hoev. et De Vriese, Tijdsch IX (1842) 160 p.p.; Engler (1879) 494 p.p.; Engler et Krause (1920) 69 pro parte *typica* (ex altera parte *Colocasia gigantea*).

The binomial *Alocasia macrorrhiza* must be typified on *maximum macrorrhizon zeylanicum* Herm., Parad.

Bat. (1698) 73 t. 73 which represents the large green form common in Malaysia and Ceylon. The type was an edible race cultivated in Ceylon.

A faulty terminology employed by LINNAEUS in describing this species misled some botanists (e.g. HOOKER, 1893) to use the binomial to denote a mountainous or semi-tropical species from India whose correct name should be *Alocasia odora* (Roxb.) Koch. The latter has peltate leaves, whereas the leaves of the former are sagittate. In India the real *A. macrorrhiza* goes under the name of *A. indica* (Lour.) Schott, though there are evidences that some species of *Xanthosoma* are also included under that name.

In Ceylon and Malaya and other tropical countries where *A. odora* does not occur even as an escape and where *A. macrorrhiza* appears to be native, the name *A. macrorrhiza* is usually correctly employed, but almost all its published descriptions and the synonymies reveal the influence of HOOKER f. who was one of the first to use *A. macrorrhiza* as the correct name for *A. odora* (cf. also THWAITES, 1861, and HOOKER f. 1893); but the binomial *A. indica* has been generally used to name the edible species of *Xanthosoma* long introduced in these parts from America. Some races of the type form of *Alocasia macrorrhiza* furnish a very palatable rhizome, but others are too acrid to be fit for human consumption. I have not been able to detect any external differences in these races.

## 2. *Alocasia macrorrhiza* var. *variegata* (Schott) Furtado comb. nov.

*A. indica* var. *variegata* (Koch et Bouché) Schott (1860) 115; Engler (1879) 502; Engler et Krause (1920) 88.

*A. macrorrhiza* var. *brisbanensis* Bailey, Queensl. Flora V (1902) 1697. **Syn. nov.**

*A. variegata* Koch et Bouché in Index Sem. Hort. Berol., 1851 app. p. 5.

I have not been able to consult the original description of this variety, and so I have followed the interpretation given to it by ENGLER (1879) and ENGLER and KRAUSE (1920) who had access to KOCH's original description as well as to the living plants, or their progeny, and the type herbarium material studied by KOCH.

It is a smaller form than the type and includes the races described extensively by ROXBURGH (1832) under *Arum indicum* Lour. It is characterised by the presence of transverse brownish or purplish, irregular lines or marks on the petiole. I have seen only two races of this variety; in the one the markings are very conspicuous, and in the other they are faint. The former race appears to be the

typical form of this variety, while the latter is cultivated in Java and Bengal for its edible rhizomes, and also for its marble-sized tubers produced at the end of long root-like structures. ALSTON (1931) records the presence of this variety in Ceylon. Apparently both races furnish edible tubers.

3. *Alocasia macrorrhiza* var. *marmorata* Furtado var. nov.

*Planta minor quam forma typica. Petiolus viridis maculis albescentibus, irregularibus, paucis variegatus. Foliorum lamina maculis similibus, majoribus conspicuis praedita, interdum per unum latus totum albescens.*

This inedible variety is often cultivated in gardens as *Alocasia variegata* or *Alocasia indica* var. *variegata*, a name which, according to the descriptions given by ENGLER (1879) and by ENGLER and KRAUSE (1920), should be applied to the variety having transversely clouded petioles. The petioles in this variety have a few large, creamy spots and the leaf-lamina bears large similar markings: sometimes the entire half is cream.

The type specimen described here was taken from plants grown in the Singapore Botanic Gardens from tubers received from Calcutta Botanic Gardens.

4. *Alocasia macrorrhiza* var. *nigra* Furtado var. nov.

*A forma typica, cui in aspectu et dimensionibus similis, haec varietas differt petiolis et nervibus primariis in superficie laminae inferiore nigro-purpurascens.*

This form is large-leaved like the type form but has purple or violet colour in petioles and in the primary nerves in the lower surface of the leaves. In some measure it is easy to confuse this variety with *A. macrorrhiza* var. *rubra*, from which it is easily distinguished by the larger leaves, by the absence of purplish colour in the lower surface of the leaves (excepting nerves), by the upper leaf-surface being dark green (not dark olivaceous green), by the spathes being much longer than the spadices. The young leaves are usually green whereas in the var. *rubra* they are practically purplish in both surfaces.

The plant is quite common in Malaya and often passes as *A. indica* var. *metallica* and *A. indica* var. *violacea*. The stems attain a height of about 6 feet or more, but they are not edible even after a prolonged boiling.

5. *Alocasia macrorrhiza* var. *rubra* (Hassk.) Furtado comb. nov.

*A. indica* var. *metallica* Schott (1860)145 (the trinomial was not published by Schott, though the variety was indicated); Engler (1879)502; Engler et Krause (1920)88.

*A. indica* var. *rubra* (Hassk.) Engler in Engler et Krause (1920) 88.

*Colocasia indica* var. *rubra* Hassk., Pl. Jav. Rar. (1848) 145.

*C. odorata* var. *rubra* Hassk., Cat. Bogor. II (1844) 55.

This very ornamental variety has much smaller leaves and spathes than *A. macrorhiza* var. *nigra* with which it is often confused. The spathe in var. *rubra* is slightly longer than the spadix, and the purple colour is present in the lower surface of the leaves. Juvenile leaves are nearly purple in both surfaces, but the upper surface becomes dark olivaceous green having a very pleasant polish.

The plant is used medicinally by Javanese who also grow the plant around their houses as a protection against thieves and burglars; for the Javanese believe that this plant has the property of causing a cough in anyone who approaches the plant at night, and coughing would warn the inmates of the houses of the presence of any unwanted guests in the neighbourhood.

## 8. Varietates Dubiae vel Excludendae

1. *Alocasia indica* var. *diversifolia* Engl. in Engl. et Krause (1920) and its synonym *A. indica* var. *heterophylla* Engl. (1879) are synonyms of *A. Portei* (Shott) Engl. cf. Merrill (1922).

2. *Alocasia indica* var. *violacea* Engl. (Engler et Krause, 1920).

This was based on a specimen cultivated in the Royal Botanic Gardens, Calcutta. Tubers received from these Gardens under the name of *A. violacea* proved to be of a form of *Xanthosoma violaceum*. ENGLER based this variety apparently on sterile material and the description, which is applicable also to *X. violaceum*, is insufficient to determine its exact identity.

3. *Alocasia taliha* Elmer (1938).

The type of this species was cited by MERRILL (1922) under *A. macrorhiza*. ELMER, finding it to be quite distinct from this species, described it as new, stating at the same time that it might not be an *Alocasia* at all. Since in the description of the spadix ELMER did not note a sterile appendix which he described in a true *Alocasia* species, *A. taliha* is, I suspect, a species of *Xanthosoma*. ELMER recorded that the species was cultivated for its edible tubers.

4. *Colocasia indica* var. *atroviridis* Hassk. (1844).

HASSKARL did not give any description of this variety but referred it to "*Ari indici secunda species Rumph. amb. V. p. 308*". The Rumphian description is too meagre for its certain identification; but the words "*caules subtus fusci*"

sunt, at talibus lineis seu venis distincti, et maculati" suggest the form described here as *A. macrorrhiza* var. *variegata*.

5. *Colocasias indica* var. *pullida* Hassk. (1814).

HASSKARL referred this variety to "Ari indici tertia species Rumph. amb. V p. 308". It is difficult to identify this variety from the Rumphian description, though "caules albicantes, seu pallide virentes" suggest *Colocasia gigantea*.

6. *Colocasia odorata* var. *viridis* Hassk. (1814).

This was a varietal name proposed for the type form of what HASSKARL called *C. odorata*; but it is difficult to find how he really interpreted this species. *C. odorata* was formerly used indiscriminately to name any large species of *Alocasia* cultivated in the European hot-houses and the binomial was supposed to be an orthographic variant of *C. odora* Lindl. (1822).

### 9. Literature Consulted

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THE TYPIFICATION OF *CALOPHYLLUM CALABA* L.

By C. X. FURTADO,

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In the prologue of *Calophyllum Calaba* L., Spec. Pl. ed. 1 (1753) 514 LINNAEUS gave a number of references which show that the species included at least three elements or syntypes: (1) a Ceylon element, (2) a Malabar element and (3) an American element. The American element was described and figured by PLUMIER under the Caribbean name *Calaba* (PLUM., Gen., 39 t. 18), and references to PLUMIER'S plant are found in pre-1753 works of LINNAEUS, namely in Fl. Zeyl. (1747) 90, no. 202, and in ROYEN, Fl. Leyd. Prodr. (1740) 476, both cited in the prologue of *C. Calaba* L. In addition a reference to PLUMIER'S *Calaba* was made by LINNAEUS in his Gen. Pl. ed. v (1754) 229 and ed. vi (1761) 266, works having an important bearing on the interpretation of the genera published in LINN., Sp. Pl. ed. i (1753) and ed. ii (1763) (Art. 20). The particulars given in the prologue concerning the habitat of the species includes also the West Indies, for the habitat is stated to be "in Indiis", a phrase frequently employed by LINNAEUS to indicate that a plant occurs in the East as well as in the West Indies.

In view of this inclusion of the American element in the prologue of *C. Calaba* and in view of the facts:—that LINNAEUS adopted the American vernacular name as the scientific epithet of the species; that the treatment given by LINNAEUS in Gen. Pl. eds. v & vi included the American element as a syntype of the genus *Calophyllum*; and that *C. Calaba* was the only species of the genus as published in 1753 to include an American element, it is not surprising that botanists in general should typify *C. Calaba* on the American syntype and make this species as the lectotype of the genus.

I have not been able to consult the treatment given to the different syntypes of the species by WILLDENOW, who in his Spec. Pl. (1800) 1160 suspected the Asiatic elements to be different from the American one, and who is reported to have later published *C. apetalum* Willd. (Mag. Ber. 1811, p. 79) for an Asiatic element of *C. Calaba*. In the absence of the original description of *C. apetalum*, it is impossible to decide which of the Asiatic elements from *C. Calaba* was included in *C. apetalum*; and the subsequent reports are somewhat contradictory. However it is quite certain that A. DE CANDOLLE (Prodr. I, 1824, pp. 562–563) reserved the binomial *C. Calaba* exclusively for the Caribbean element, and published *C. spurium* Choisy ex DC. to include *C. apetalum* Willd. and at least the Malabar element of *C. Calaba*.

Owing, however, to the contradictory typification of *C. apctatum* and *C. spurium*, some having typified them on the Malabar syntype and others on the Ceylon one, these two binomials have been generally disregarded and later ones are in use, namely, *C. decipiens* Wight (= *C. Wightianum* Wall.) for the Malabar element, and *C. Burmanni* Wight for the Ceylon element.

This exclusion of the Asiatic elements from *C. Calaba* was so generally adopted that, at the Cambridge Botanical Congress (1930), the British Botanists proposed that the genus *Calophyllum* L. (1753) should be typified on *C. Calaba* L. *quoad* the American element. According to a decision of the 1935 Botanical Congress, Amsterdam, this proposal should be followed unless there are grave reasons for adopting another type; and so far no serious reasons have been brought forward for disregarding the type proposed by the British Botanists.

It is true that there have been a few opponents to this general typification of *C. Calaba*. One of the first to select a lectotype of *C. Calaba* from the Asiatic elements was LAMARCK (Encycl. I, 1783, p. 553) who typified *C. Calaba* on the Malabar element quoted as Tsjerou-ponna, RHEEDE, Malab. 4, p. 81, t. 39, in the prologue of the species, interpreting at the same time *C. inophyllum* L. in a wide sense to include not only the Ceylon and the American elements of *C. Calaba*, but also a new one from Madagascar later named as *C. Tacamahaca* Willd. (1811). Had it not been for the fact that the genus *Calophyllum* has to be interpreted on *C. Calaba* L. *quoad* the American element (included also in LINN., Gen. Pl. eds. v & vi) on the recommendations by the 1930-1935 Botanical Congresses, a very strong case could have been made in favour of this Lamarckian typification of the species; for RHEEDE's plate of Tsjerou-ponna is quoted directly in the prologue of *C. Calaba* as well as in two out of the three additional references given in the prologue, while there is an indirect reference to this plate also in the third citation.

To my knowledge TRIMEN (Journ. Linn. Soc., Lond., XXIV, 1887, p. 143) was the first to assert that the Ceylon element alone should be considered in typifying *C. Calaba*. TRIMEN was then working on HERMANN's herbarium in the British Museum, London, and had typified, correctly as *C. Burmannii* Wight, HERMANN's specimen cited by LINNAEUS under *C. Calaba*; but, apparently not realising that other elements were also included in the prologue of *C. Calaba*, TRIMEN remarked as follows:—

"The name *C. Calaba* has been generally abandoned for this Eastern species to which it originally belongs, in consequence of JACQUIN having figured in 1763 (Hist. Select. Stirp. Amer. t. 165)

as LINNAEUS's species the Martinique plant, to which PLUMIER first gave the generic name *Calaba*, taken from the Caribbee name. LINNAEUS (Sp. Plant. ed. ii, p. 732) accepted JACQUIN's determination, and hence makes his own species to include both the E. and W.—Indian plants. The name should not be maintained for either."

This view of TRIMEN ignores the Malabar and the American elements from the prologue of *C. Calaba* L. (1753) and therefore cannot be accepted. Yet RENDLE and FAWCETT (Fl. Jamaica V, 1926, p. 200) supported TRIMEN's views by creating the name *C. Jacquinii* for the American element of *C. Calaba* and by remarking as follows:—

"*C. Calaba* L. Sp. Pl. 514 (1753) is founded on a Ceylon plant (Fl. Zeyl. no. 202) named later *C. Burmannii* Wight (III. i, 128, 1838) a different species from the West Indian plant described by JACQUIN under the same name. In Sp. Pl. ed. ii, 732, LINNAEUS added the reference to JACQUIN."

The logical development to these erroneous assumptions of TRIMEN and of RENDLE and FAWCETT concerning the syntypes of *C. Calaba* L. (1753) culminated when ALSTON in his Suppl. to TRIMEN, Fl. Ceyl. (1931, p. 22) adopted *C. Calaba* L. as the correct name for the Ceylon plant with *C. Burmannii* Wight as its synonym. In this treatment of the Ceylon plant, ALSTON has been followed by VAN OOTSTROOM (Blumea, Suppl. I, 1937, p. 196), and by ABEYESANDERE and ROSAYRO (Descript. Check-List Ceyl. 1939, p. 34), despite the fact that this treatment, based as it is on erroneous assumptions, renders it impossible to typify *Calophyllum* L. (1753–1754) on the American element as recommended by the 1930 and the 1935 Botanical Congresses.

In view of the foregoing considerations I submit that *C. Calaba* L. should be accepted as the correct name for the American element named as *C. Jacquinii* by RENDLE and FAWCETT, and its use for any of the Asiatic elements should be rejected as illegal. The nomenclatural treatment proposed here is also in accordance with the procedure which, in my opinion, should be followed in order to secure stabilisation in the nomenclature of plants (FURTADO in Gard. Bull. Straits Settl. IX, 1937, pp. 244–249 and 296–299). Under more recent interpretations of the rule of *nomina ambigua* (Art. 62) it would be possible to demand the rejection of the binomial *C. Calaba* L. as an impriorable name on the grounds that its use in different senses has become a source of confusion; but such a demand has been argued by me to be contrary to the very fundamentals of the Nomenclatural Rules (FURTADO in Gard. Bull. Straits Settl. XI, 1939, pp. 7 and 28).

### **CHANGE OF TITLE**

The Colony of the Straits Settlements has ceased to exist. The title of this Bulletin is now therefore changed, but the present issue is a direct continuation of the former Gardens' Bulletin, Straits Settlements, of which the last issue was Vol. XI, part 3, published 30 August 1941.



# THE GARDENS' BULLETIN SINGAPORE

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## THE SINGAPORE BOTANIC GARDENS DURING 1941-46

Prior to the Japanese attack on Malaya, most of the senior staff of the Gardens were seconded for other duties under the Departments of Food Control and Information, for at least part of the time. The result was that botanical work was reduced, and considerable arrears of unnamed and undistributed specimens accumulated. The Gardens were maintained as usual, with the addition of demonstration plots of vegetables.

After the attack on Malaya, Messrs J. C. Nauen (in charge of the Waterfall Gardens, Penang) and G. H. Addison, horticultural officers, were mobilized with the local defence forces; they were subsequently taken prisoner and sent to work on the Siam-Burma railway, where Mr. Nauen lost his life. An appreciation of Mr. Nauen's services is given elsewhere in this issue. Mr. J. L. Pestana, Laboratory Assistant, was similarly taken prisoner and sent to Siam. Mr. J. W. Ewart, the third senior horticultural officer, was on leave, and was later transferred temporarily to the Dept. of Agriculture, Gold Coast. Mr. M. R. Henderson, Curator of the Herbarium, was evacuated from Singapore with the Dept. of Information, and subsequently worked in the herbarium of the National Botanic Gardens, Kirstenbosch, South Africa. Messrs R. E. Holttum and E. J. H. Corner remained in Singapore during the Japanese occupation; also Dr. C. X. Furtado, Assistant Botanist.

At the time of the Japanese attack on Singapore, fighting ceased on a line about half a mile from the Gardens boundary. Part of the Gardens was occupied by defending troops, and a considerable number of small shells were fired by the Japanese into the Gardens. Most of these exploded in tree-tops, and caused some casualties later among the trees. A few small trees were damaged owing to the digging of trenches and other operations, but on the whole the woody plants of the Gardens suffered little serious damage. The Director's house had a direct hit from a shell, and the Gardens Store was slightly damaged by a

bomb which exploded 20 yards away. The offices and herbarium were undamaged. The local Gardens staff nearly all remained at their quarters, where they had good shelters: three or four of them suffered minor injuries.

Three days after the Japanese occupation, Professor Hidezo Tanakadate, of Tohoku Imperial University, assumed control of the Gardens. He asked Mr. Holtum to remain in executive charge, and to resume all normal horticultural work. The Japanese military required the supply of some ornamental plants, but only such as were easily propagated. Professor Tanakadate and his successors took energetic steps to see that the Gardens were not in any way despoiled by the Japanese military; and the same action was also taken with regard to the Nature Reserves in Singapore Island under the control of the Gardens. Prof. Tanakadate arranged for the Botanic Gardens and Raffles Museum to form a single Department under the Municipality of Singapore, with head office at the Museum. In Sept. 1942 the Marquis Yoshichika Tokugawa assumed the office of Honorary President of the Museum and Gardens; this he held until his departure for Japan in the middle of 1944.

In December 1942 Professor Kwan Koriba, Professor of Botany at the Imperial University of Kyoto, was appointed Director of the Gardens. Thereafter Mr. Holtum ceased to have responsibility for garden work, but unofficially both he and Mr. Corner remained in constant touch with the local staff and advised them in their work. Garden work continued throughout the Japanese occupation, but greatly deteriorated for various reasons. More than half the outdoor staff (49 men) were sent by the Japanese military to work in the Siam-Burma railway; some of those remaining were taken for planting experimental crops of medicinal, fibre and dye plants in the adjoining Tyersall estate, and latterly all spent part of their working time in food production; tools also were gradually reduced both in number and quality. Fortunately the motor mowers were maintained in good running order throughout, so that the grass of the main lawns never got out of hand. Many outlying parts of the Gardens were neglected and became overgrown, and there were considerable losses in some collections of smaller plants. Stocks of pot plants were greatly reduced.

Wages for local staff at the end of the Japanese occupation were less than double the wages of 1941, but prices gradually increased to about 500 times those of 1941, with the exception of a small and diminishing fixed-price ration of rice, sugar and oil. Municipal employees, including those of the Gardens, were at a great disadvantage as

compared with persons employed directly by the Japanese military; but most of the Gardens staff, both indoor and outdoor, remained at their work. Had they not done so, the Gardens could not have been maintained as they were, nor so quickly rehabilitated in 1946. In this connection, special credit is due to Mr. Quan Ah Gun, Chief Clerk, and to Dr. Furtado. Of the men who were sent to work on the Siam-Burma railway, twenty-two lost their lives. These included both Indians and Malays.

Prof. Koriba obtained permission for Messrs. Holttum and Corner to remain in the Gardens and continue their botanical work. Mr. Corner continued his researches on the larger fungi, and also made elaborate investigations of the development of flowers and fruits in various families of trees, from the appearance of the first floral rudiments to ripe fruits and seeds. Mr. Holttum spent most of his time preparing new descriptions of Malay Peninsula representatives of the following groups: Ferns, Orchidaceae, Zingiberaceae, Marantaceae, Gramineae, Cyperaceae.

The Herbarium remained intact (except for the loss of some specimens on loan in Germany) and also the library. All the Japanese scientific officers concerned were insistent that the Herbarium and library (as also the collections at the Raffles Museum) should be preserved as part of the cultural heritage of Malaya, and on this basis the British staff cooperated with them. We should like to express our gratitude to Professor Koriba and others concerned for the disinterested way in which they carried out their duties, and also for much personal courtesy and kindness. Professor Koriba himself carried out a research into the growth-behaviour of some Malayan trees.

From September 1945 to March 1946, under the British Military Administration, the Gardens were under the care of Dr. Gilbert Archey (Director of the Auckland Museum, New Zealand), who was responsible for Monuments, Fine Arts and Archives. Mr. Holttum left for England on September 18th. Mr. Corner remained in Singapore in immediate charge of the Gardens until November 11th. Mr. J. W. Ewart returned soon afterwards and had charge of the Gardens until the return of Mr. M. R. Henderson in January 1946. Mr. Addison returned to take charge of horticultural work in April 1946, Mr. Ewart being appointed to undertake the duties of Agricultural Officer, Singapore. Mr. Holttum returned to duty as Director in May 1946.

## Mr. J. C. NAUEN

John Charles Nauen came to Singapore in July 1935 as an Assistant Curator of the Gardens. He had previously served seven years in Bermuda after completing his training as a Student Gardener at Kew. He remained in Singapore until July 1939, when he was placed in charge of the Waterfall Gardens, Penang. When the Japanese attacked Malaya in December 1941, Mr. Nauen was mobilized as Sergeant in the Penang Volunteer Force, and as such was taken prisoner in Singapore in February 1942. He was subsequently sent to work on the Siam-Burma railway, where he died as a result of blood poisoning in October 1943.

Mr. Nauen was an officer of outstanding ability; and as a man he was held in affection and esteem by all who knew him. He had a very wide knowledge of garden plants and their management, excellent judgment in their use and arrangement, and a great gift in garden design. He devoted much thought to his administrative work and to the welfare and training of those who worked under him. He helped considerably to raise the standard of horticultural work in the Gardens both at Singapore and Penang. He devoted much time and thought to the roadside trees of Singapore. He helped to found a Gardening Society in Singapore, and did good service as its first Secretary. He was the leading spirit in the organization of the Society's Flower Shows, which were a stimulus to professional and amateur growers alike. His alert mind, his sense of humour, his human sympathy, and his integrity of purpose are the characters by which we remember him. His untimely death is a great loss to Malaya.

## NEW SPECIES OF VASCULAR PLANTS FROM THE MALAY PENINSULA

By R. E. HOLTUM

During a survey of the ferns, orchids, grasses and Cyperaceae of the Malay Peninsula, based on all specimens in the Singapore herbarium, a number of undescribed species were found. These are described below. It is hoped that full revised accounts of all these families, as represented in the Malay Peninsula, will be published later. Various changes of names, found necessary during the work, are also here published.

### FILICALES

*Schizaea paucijuga* Holtt., sp. nov.

*Rhizoma* parvum, apice pilis tenuibus brunneis c. 1½ mm. longis vestitum; *frondes* simplices, c. 8–20 cm. longae, basi teretae, supra basin sensim in laminam angustissimam costatam transientes, haud 1 mm. latae, apice 2–5 lobos fertiles 7–15 mm. longos ferentes; *lobi fertiles* margine glabri, sporangia biseriata pilis brunneis intermixta ferentes.

TYPUS: Kedah Peak, alt. 3000 ped., S.F.N. 1098, leg. Md. Haniff.

This plant has the aspect of a small *S. digitata*, with a distinctly costate but very narrow blade, and the fertile lobes apparently digitately arranged. The lobes are also very like those of *S. digitata* in appearance, but they have only two rows of sporangia and the sporangia are accompanied by hairs as in *S. dichotoma*. It is thus somewhat intermediate between *S. digitata* and *S. dichotoma* (nearer the latter) but has fronds no wider than those of *S. malaccana*. It has the rhizome-hairs of *D. digitata*.

*Phymatodes subfasciata* Holtt., sp. nov.

*Rhizoma* breve, c. 2 mm. diametro, frondes confertas ferens; *paleae* haud 3 mm. longae, basi haud 1 mm. latae, margines pilis brevibus paucis instructae, tenues, rufo-brunneae. *Stipites* haud basi anguste decurrente frondis distincti, ad summum 2 cm. longi. *Frondes* tenuiter coriaceae, ad 20 cm. longae et 12 latae, oblanceolatae, apice obtusae vel rotundatae, margine manifeste serrulatae, dentes 3–4 mm. dissiti, venae obscurae. *Sori* in seriebus irregularibus 1–4 inter costam et marginem dispositi, sori bini in serie quoque inter venas adjacentes, non immersi, parvi sed interdum contigui; *frondes steriles* fertilibus similes, paucae.

TYPUS: Fraser's Hill, S.F.N. 21559, leg. Holttum.

This species is near *Polypodium subsparsum* Baker (Sumatra) but differs in the much closer hardly stalked fronds, the much more distinctly toothed edges, and smaller sori in more series on larger fronds.

**Grammitis crispatula** Holtt., sp. nov.

*Paleae* rhizomatis angustae, acutae, 2 mm. longae, pallide brunneae, integrae. *Stipites* c. 1 cm. longi, pilis rufis confertis patentibus  $\frac{1}{2}$  mm. longis vestiti. *Frondes* tenues, 4–10 cm. longae, 6–8 mm. latae, basi abrupte angustatae, apicem versus sensim angustatae, apice obtusae, marginibus omnino crispatulis, utroque latere pilis brevissimis patentibus vestitae. *Venae* unifurcatae, rami inaequales, ramus acroscopicus brevior, cum costa parallelus, ramus basiscopius longior, patens, marginem non attingens; *sori* ramos acroscopicos venarum occupantes, prope costam, non contigui.

TYPUS: Perak, Maxwell's Hill, 3300 ped. alt., S.F.N. 12705, leg. Burkill, 6 March 1924.

This species is characterized by its short hairs and simple basal vein-branch.

**Ctenopteris sparsipilosa** Holtt., sp. nov.

*Rhizoma* breve, erectum, frondes fasciculatas ferens; *paleae* angustae integrae, pallide brunneae, ad 4 mm. longae. *Frondes* brevissime stipitatae, 7–15 cm. longae, 4–7 mm. latae, apicem et basin versus sensim angustatae, dimidio costam versus pinnatifidae, costa pilis brevibus adpersis pallidis (vel rufis ?) instructa; lobi laminae basi 2–2½ mm. lati, obtuse triangulares vel semi-elliptici, integri; *venae* unifurcatae; *sori* in ramis acroscopicis venarum positi, elliptici (receptaculum elongatum), leviter immersi, sporangia nuda.

TYPUS: Gunong Brinchang, alt. 6000 ped., S.F.N. 23522, leg. Holttum.

Near *Polypodium subpinnatifidum* Bl. of Java, Sumatra and Borneo, differing in the absence of spreading hairs on the frond, in broader fronds, with the lower edges of the lobes never revolute, distinctly elongate sori and non-setose sporangia.

**Thelypteris herbacea** Holtt., sp. nov.

*Caudez* brevis, erectus. *Stipites* fasciculati, ad 30 cm. longi, tenues, basi excepta pallidi, ex toto capillis mollis pallidis brevibus vestiti; *squamae* breves, angustae, fere nigrae, mox deciduae, raro in frondibus adultis persistentes. *Lamina* fere ad 35 cm. longa et 13 cm. lata, pinnae liberae fere 15-jugatae, inter se distantes c. 2.5 cm., infimae

deflexae sed non reductae; *pinnae maximae* c. 7 cm. longae et 13 mm. latae, acuminatae, sessiles, margine  $3/4$  ad costam lobatae; *lobi* oblongi, obtusi, integri, 2.5–3 mm. lati; lobus infimus acroscopicus leviter elongatus et interdum ad costam incisus; textura laminae tenuis, herbacea; color in sicco pallide olivaceus; *rachis* straminea, supra dense pilis brevibus, infra pilis patentibus pallidis paucioribus vestitae; *costae* supra pilis crassulis pallidis appressis vestitae, pili similes super venas et margines adpersi; *costae* infra pilis brevioribus, tenuioribus, patentibus, pallidis vestitae; pili pauci similes venas adpersi; glandulae nullae. *Venulae* in lobis simplicis, 4–5-jugatae, pallidae, utrinque distincte elevatae; sori in medio venarum aut leviter infra medium; indusia reniformia, brunnea, persistentia, pilis rigidis pallidis paucis instructa.

TYPUS: G. Tahan, S. Reriang, alt. 3000–3500 ped., S.F.N. 20571, leg. Holttum. Also G. Tahan, Wray's Camp, Ridley 16212; G. Padang (Trengganu), 4000 ft., Moysey s.n. 26.6.1937.

This is most nearly related to *Dryopteris pectiniformis* C. Chr. but differs in the scales on the stipe being smaller, darker and not persistent, the pinnae smaller but with broader blunt segments, the surfaces not glandular. It is possible however that *T. herbacea* may exist in two varieties, one with glands and one without, like *D. pectiniformis*. *T. herbacea* differs from *D. viscosa* (J. Sm.) C. Chr. in the pale stipes and rachis, deciduous scales, thinner texture of the lamina and absence of superficial yellow glands.

*Cyclosorus ecallosus* Holtt., sp. nov.

*Caudex* brevis repens; *stipites* fasciculati, basin versus squamulis angustis brunneis vestiti, cetera glabri, ad 100 cm. longi. *Lamina* 100 cm. longa et ultra, 45 cm. lata. *Pinnae* multijugatae, sessiles; *pinnae infimae* 2- vel 3-jugatae haud 2 cm. longae, basi acroscopica valde auriculatae; *pinnae subbasales* basin versus leviter angustatae, basi acroscopica auriculatae (auriculae magnae, lobatae); *pinnae mediales* et superiores basi truncatae vel late cuneatae, maximae c. 28 cm. longae et 2.5 cm. latae, apice longe acuminatae, margine dimidio costam versus incisae; *lobi* fere recti, patentes, truncati, apicem versus leviter dentati, basi c. 5 mm. lati; textura laminae tenuis, in sicco subtus verruculosa; *rachis* et *costae* supra hirsutae, lamina cetera glabra; *venulae* 7–10-jugatae, subtus pallidae et valde prominentes, infimae solum anastomosantes, vena excurrentis recta, ad basin membranae sinus terminata; *venulae* sub-basales latera membranae attingentes, ceterae ad marginem liberam lobi terminatae; sori inframediales,

in ordinibus duobus cum costulis parallelis; indusia persistentia, integra.

TYPUS: Pahang, Cameron Highlands, alt. 5000 ped., S.F.N. 31294, leg. Holttum. Also same locality, S.F.N. 23427, leg. Holttum. This is closely allied to *C. truncatus* (Poir.) Farw., agreeing in texture and verrucose character of the lamina, in the sori arranged in two parallel rows near the costules, and in pubescence. It differs in having the few lower pinnae prominently auricled on the upper base, with 2 or 3 pairs of greatly reduced pinnac below them, and no small auricles on the stipe, and in having only one pair of veins truly anastomosing, the next pair meeting the sides of the sinus-membrane which is somewhat longer than in *C. truncatus*.

*Elaphoglossum peninsulare* Holtt., sp. nov.

*Rhizoma* breve, c. 5 mm. diam.; *paleae* fusco-brunneae, angustae, acuminatae, marginibus irregulariter dentatis vel lobatis. *Stipites* frondium sterilium supra articulationem nulli, infra articulationem 10–15 mm. longi; stipites frondium fertilium 7–15 cm. longi, in juventute dense paleacei. *Fronde* steriles coriaceae, ad 40 cm. longae et 6.5 cm. latae, oblanceolatae, basin versus sensim angustatae, apice obtusae, margine non cartilagineae, infra in juventute paleaceae, paleae costales eis rhizomatis similes sed minores, paleae paginae minutae, stellatae, multiradiatae. *Fronde* fertiles quam sterilibus breviores, 17–37 cm. latae.

TYPUS: Patani (Lower Siam), Betong, Ban Chanaka, 210–350 m. alt., leg. Eryl Smith 2021, 9 August 1923. Also: Penang Hill 2000 ft., Holttum s.n. 6.1.1937; Richmond Pool, Ridley s.n. 1898. Pahang, Tahan River, Ridley s.n. 1891.

This species grows with *E. melanostictum* (Bl.) Moore on Penang Hill and is rarely fertile. It is easily distinguishable from *E. melanostictum* by its broader fronds, more abruptly narrowed to the bluntly pointed apex, and in its thicker texture. The scales on the lower surface are also more conspicuously stellate, and the fertile fronds very much wider than those of *E. melanostictum* (which are only 1 cm. wide).

*Elaphoglossum brevifolium* Holtt., sp. nov.

*Rhizoma* paleaceum ei *E. callifolii* simile; *stipites* frondium sterilium 4–12 cm. longi, frondium fertilium 20–25 cm. longi, infra laminam anguste alati, in juventute paleacei, paleae partim eis rhizomatis similes, partim parvulae irregulares. *Fronde* steriles crasse carnosae, 8–12 cm. longae, 3.5–6 cm. latae, basi anguste cuneatae, apice obtusae, marginibus  $\frac{1}{2}$  mm. latis pellucidis, frondes juveniles infra paleis minutis irregulariter stellatis adpersis instructae. *Fronde* fertiles 8–10 cm. longae, 2–3 cm. latae.

TYPUS: Pahang, G. Tahan, alt. 4500 ped., S.F.N. 20750, leg. Holttum, 2 September 1928.

This species has been found on G. Tahan by two other collectors, and a small specimen also on G. Batu Puteh (Main Range, Perak) at 4500–6000 ft. The short broad blunt fleshy fronds with very conspicuous cartilaginous edge, and the very long stipes of the fertile fronds are characteristic.

***Bolbitis singaporensis* Holtt., sp. nov.**

*B. quoyanae* affinis, differt: pinnis crenatis vel paululo lobatis, basi antice late cuneatis plerumque auriculatis, postice angustioribus, rotundatis; venulis areolas costales et costulares formantibus, areolis ceteris paucis, interdum nullis; costulis maxime 6 mm. dissitis.

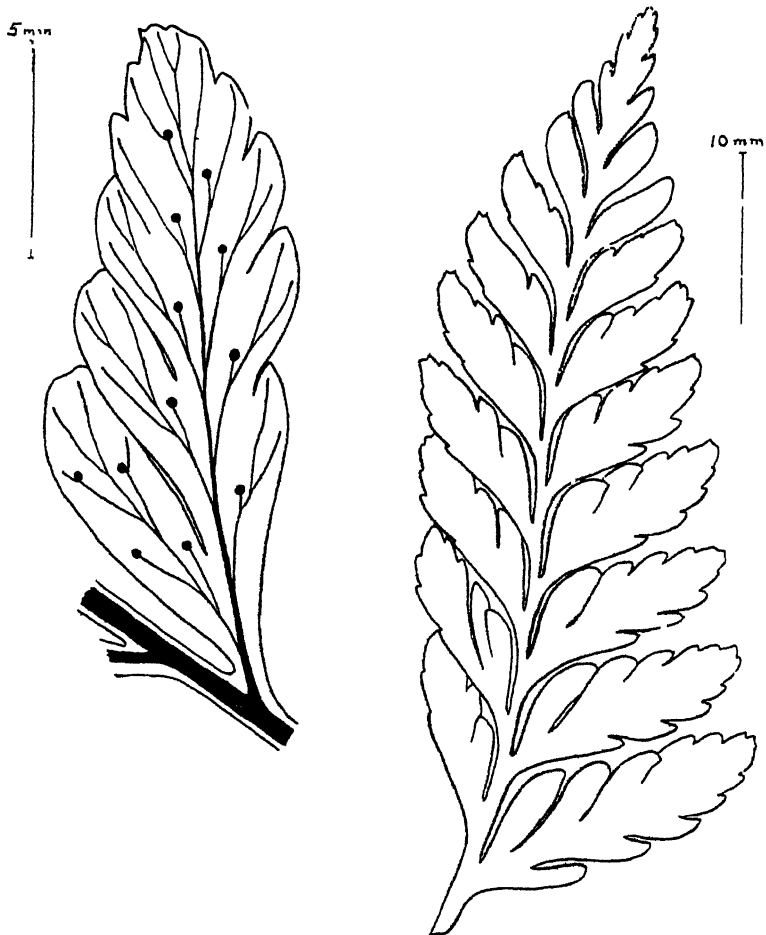
*Rhizome* creeping, the apex bearing thin narrow dull brown scales c. 5 mm. long. *Stipes* close together, green when living, pale when dry, bearing scattered scales throughout, to about 25 cm. long in sterile and 40 cm. in fertile fronds. Lamina of *sterile frond* to about 45 cm. long and 20 cm. wide, pinnae about 12 pairs below the narrowly deltoid lobed pinnatifid apical portion; lowest pinnae slightly shorter than those next above, hardly stalked, subequally cuneate at the base; remaining pinnae to about 13 by 2.5 cm., subtruncate or broadly cuneate and usually slightly auricled on the anterior base, rather narrowly rounded on the posterior side, the margins crenate or shallowly lobed, the crenations or lobes entire except for a single (usually small) tooth often present in the sinuses; texture firm-herbaceous, drying rather dark olivaceous, the smaller veins not clearly raised on either surface; costules 5–6 mm. apart, at about 60° to the costa, straight; veins forming a regular series of costal areoles and usually a few costular areoles, with at most one other series of areoles between those of adjacent costules; in the distal part of some pinnae all veins free except for the costal areoles. *Fertile fronds* with about 10 pairs of pinnae, pinnae to about 6.5 cm. long and 8 mm. wide, the margins entire or crenate, the apex blunt, veins as in the sterile fronds but much closer together, bearing sporangia throughout, the sporangia filling the whole lower surface at maturity.

TYPE: Bukit Timah, Singapore, Hullett s.n., March 1882 (2 sheets).

This is intermediate between *Bolbitis quoyana* and *Egenolfia appendiculata*. It has only been collected in one valley on Bukit Timah, where both these species grow, on granite rocks in the stream bed.

**Dryopteris (§ Polystichopsis) Haniffii** Holtt., sp. nov. **Fig. 1.**

*Caudex* brevis terrestris. *Stipites* fasciculati, ad 70 cm. longi, dimidio basin versus squamulis angustis integris castaneis vel fuscis, ad 15 mm. longis et  $1\frac{1}{2}$  mm. latis dense vestiti, squamae in dimidio superiore breviores, angustiores, fusciores, in frondibus senescentibus plerumque deciduae. *Lamina* ad 55 cm. longa et 40 cm. lata, copiose tripinnata, basi quadripinnata, deltoidea; pinnae infimae maximae, pinnulae earum basiscopicae infimae quam sequentibus haud longiores. *Pinnae infimae* ad 22 cm. longae et 9 cm. latae, pinnulae maximae ad 6 cm. longae et 2 cm. latae, foliolae ordinis tertii ad 2 cm. longae et 6 mm. latae, foliolae ordinis



**Fig. 1.** *Dryopteris Haniffii*: a pinnule and a tertiary leaflet

quarti, lobique maximi pinnarum superiorum, ad 8 mm. longae et 2 mm. latae; foliolae vel lobi ultimi acuti, apice dentibus 1-3 brevibus rigidis instructae. Textura laminae subcoriacea; color supra in vivo atroviridis, nitens, in sicco atro-olivaceus; rachides, costae, laminaeque squamulis angustissimis (plerumque filiformibus) adpersis vestiti. *Venae* in foliolis pinnatae, venulae furcatae (interdum bis furcatae); *sori* in ramulis acroscopicis sedentes, terminales; indusia non visa.

TYPUS: Pahang, Cameron Highlands, Brinchang, alt. 5000 ped., S.F.N. 31286, leg. Holttum. Also G. Kerbau, alt. 6000 ft., leg. Haniff no. 4038.

This beautiful species is evidently allied to *Aspidium carvifolium* Kze., but differs in its much more finely dissected condition, with very narrow leaflets. It was first collected in 1909 by the late Mohamed Haniff, Overseer of the Waterfall Gardens, Penang, and I name it to perpetuate his memory as a discriminating collector of ferns, and as a keen field botanist from whom I learnt much.

***Athyrium angustisquamatum* Holtt., sp. nov.**

*Rhizoma* erectum, apice squamis linearibus ad 2 cm. longis haud  $\frac{1}{2}$  mm. latis brunneis nitidis leviter undulatis apicem versus dentatis dense vestitum. *Stipites* c. 45 cm. longi, basin versus nigrescentes, apicem versus in vivo virides, basin versus squamulis angustis dense vestiti, supra basin sparse squamati. *Lamina* bipinnata-tripinnatifida, c. 85 cm. longa et 70 cm. lata; pinnae infimae 30 cm. longae, stipitibus 5 cm. longis instructi; pinnae maximae 40 cm. longae et 16 cm. latae, stipitibus 2.5 cm. longis instructi; pinnulae plerumque alternae, pinnulae liberae c. 16-jugatae, infimae leviter reductae, maximae c. 9 cm. longae et 2.4 cm. latae, sessiles, basi fere aequaliter truncatae (superiores late cuneatae), apice breviter acuminatae, dentatae, margine  $\frac{4}{5}$  costulam versus lobatae; lobi leviter obliqui, c. 5 mm. lati, apice truncati vel rotundati, subintegri vel leviter crenatoserrati, sinubus angustis separati; rachides, costae, costulae, venaeque subtus squamulis angustis pallidis valde dentatis adpersis instructae, pagina supra glabra; textura laminae herbacea, color in sicco olivaceus; *venae* in lobis ad 7-jugatae, simplices, rarissime furcatae, obliquae; *sori* minuti, ad basin venarum sedentes, rotundati; receptaculum leviter elevatum; indusium non visum.

TYPUS: Selangor, Ginting Simpak, alt. 2500 ped., S.F.N. 37359 leg. Holttum.

This species has the aspect of a bipinnate species such as *A. latisquamatum* Holtt. or *A. procumbens* Holtt., but

differs most strikingly in the long very narrow medium brown shining scales, and in the very small sori. Only one fertile frond was found, and the sori are rather old.

**Taenitis dimorpha** Holtt., sp. nov.

*Frondesteriles* semper simplices, lamina ad 40 cm. longa et 4.5 cm. lata, stipites plerumque 10–20 cm. longi; *frondes fertiles* longe stipitatae, plerumque trifoliatas vel pinnatae, pinnae ad 4-jugatae, plerumque 20–30 cm. longae et 8–10 mm. latae.

TYPUS: G. Muntahak, Johore, alt. 2000 ped., S.F.N. 17399, leg. Holttum.

This species is closely allied to the variable *T. blechnoides*, but the latter always has pinnate sterile fronds on well grown plants, and there is never such a difference in width between fertile and sterile fronds. *T. dimorpha* has been found at several localities in Johore, Malacca, Selangor and Pahang, and seems quite distinct; but it grows in the same places as *T. blechnoides* and the two should be compared in the field.

**Vittaria angustissima** Holtt., sp. nov.

*Rhizoma* breve, repens, paleis 2–3 mm. longis integris anguste acuminatis dense vestitum. *Fronde confertae*, 3–9 cm. longae et 1 mm. latae, basin versus sensim angustatae; costa supra leviter canaliculata, infra plana; *sori* interdum unilaterales, interdum bilaterales, fere apicem et basin frondis attingentes, submarginales, profunde immersi; cellulae extremae paraphysium obovoideae latitudine longitudine aequales.

TYPUS: Pahang, Fraser's Hill, alt. 4000 ped., leg. C. E. Carr, March 1929. Also same locality, S.F.N. 8835, Burkill & Holttum.

This species is evidently allied to *V. parvula* Bory (*V. Lloydii* folia Racib.) of Java, but is even smaller, and differs in its smaller hair-pointed scales and in the fact that many fronds have sori on one edge of the lamina only. In the fronds which have one sorus only, the non-soriferous half of the lamina is evenly attenuated to the thin margin; where both edges are fertile, the appearance is much as in *V. angustifolia* Bl., the middle area between the sori almost flat on the lower surface, distinctly narrower than the full width of the frond, its edges raised somewhat when the sorus is fully mature with many ripe sporangia.

## ORCHIDACEAE

*Acriopsis Carrii* Holtt., sp. nov.

*A. javanica* affinis, differt: foliis ad 30 cm. longis et 1 cm. latis; inflorescentia ad 40 cm. longa, ramis pluribus (ad 12), rigide patentibus, brevioribus (5–12 cm. longis); floribus immaculatis; labello albo, gynostemium viride, cucullo brachiaque albescentibus; sepalis petalisque pallide flavescens; lamina labelli  $3\frac{1}{2}$  mm. longa, basin  $1\frac{1}{2}$  mm. lata, supra basin fere ad 1 mm. angustata, apice reflexa, emarginata, carinis  $1\frac{1}{2}$  mm. longis.

TYPUS: Gua Musang, Kelantan, 400 ft., lég. C. E. Carr, no. 135.

Also collected at Gua Musang by Henderson, by the Sungei Galas, on *Platyserium Ridleyi* (fern), epiphytic on a *Dipterocarpus* tree by the river (S.F.N. 22623); also at Bator, Kelantan by Haniff & Nur (S.F.N. 12054).

*Anoectochilus duplex* Holtt., sp. nov.

*Herba* c. 10 cm. alta; lamina folii ad 3.5 cm. longa, 2.1 cm. lata, ovata, brevissime acuta, viridis, petiolus cum vagina ad 2 cm. longus; scapus brevissimus; rachis brevis, pubescens, 3–5 flores ferens; bracteae pilis longis adspersis vestitae, ad 11 mm. longae, quam ovarium breviores; *sepalum dorsale* 5 mm. longum, late ovatum, obtusum; *petala* tenuia, sepalo dorsali agglutinata; *sepala lateralia* basi valde concava, basin labelli amplectentia, 9 mm. longa; *labellum* 12 mm. longum, in basi saccata medio carinatum, utrinque glandulis duabus instructum; lobi laterales nulli; unguis angusta, marginibus inflexis contiguus, extus utrinque lamellam dupliciter pectinatam ferens, dentes ordinis primi 4, 2–3 mm. longae, ordinis secundi minores; lamella extrema labelli bilobata, lobi  $6\frac{1}{2}$  mm. longi, 4 mm. lati; *gynostemium*  $4\frac{1}{2}$  mm. altum, rostello lato incluso, facie inferiore prope stigmata alis duobus parvis triangularibus instructum.

TYPUS: Semangkok Pass, leg. W. S. Napier, February 1904.

Also collected at Fraser's Hill by Burkill & Holttum (F.D. 7803); flowers greenish, blade of lip white. Differs from all other known species of *Anoectochilus* in the double row of teeth on the flange of the claw of the lip, and also from other Peninsula species in the short upper sepal.

*Ascocentrum micranthum* (Lindl.) Holtt., comb. nov.

Basynym: *Saccolabium micranthum* Lindl., Gen. et Sp. Orch. 220. 1833.

Synonyms: *Cleisostoma micranthum* King & Pantl.,  
Ann. Calc. 8: 234, pl. 312. 1898.

*Saccolabium fissum* Ridl., J. Linn. Soc. 32: 361. 1896.

There is a drawing of Ridley's species at Singapore, and I have examined the type specimen. I cannot see that it differs from Pantling's drawing. It does not belong to the genus *Cleisostoma* (now called *Pomatocalpa*), having no appendage in the back of the lip. If the flowers were much enlarged, the species would be placed in the genus *Vanda*. I am not sure that it is properly placed in *Ascocentrum*, but can find no other genus for it.

**Bulbophyllum** (§ *Micromonanthae*) **nigromaculatum** Holtt.,  
sp. nov. Fig. 2.

*B. tenuifolium* Lindl. affinis, differt: pseudobulbis majoribus (1.5 cm. longis) non angulatis; sepalis multo longioribus (9–10 mm. longis), sepalis lateralibus obscure purpureo-striatis, sepalo dorsale venulis 3 viridibus instructo; petalis margine maculis nigris 3 ornatis; labello majore (7 mm. longo), basin versus atropurpureo, basi infra papilloso.

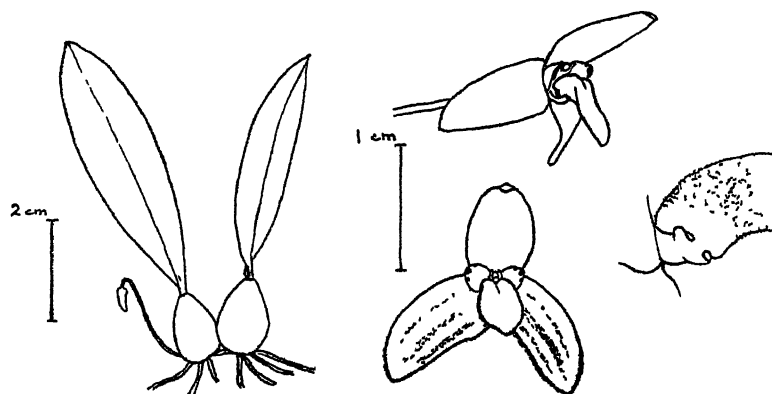


Fig. 2. *Bulbophyllum nigromaculatum*: plant; flower in face and oblique view; base of lip from below.

*Pseudobulbs* almost touching, ovoid, to 1.5 cm. long, flushed with purple; leaf to 6 by 1.5 cm., hardly stalked, base flushed with purple; scape 2 cm. long, pedicel 3.5 cm.; *sepals* pale green, laterals slightly flushed with purple along the veins, upper with 3 green veins, all 9–10 mm. long, 4½–5 mm. wide, abruptly short-pointed; *petals* 3 mm. long, nearly circular, pale yellow with apical black spot and a smaller one on each side of it; lip bent at right angles close to the base, 7 mm. long, 3 mm. wide, tongue-shaped, base dark purplish with a yellow median groove, apex

yellow with purple spots, lower surface purple, papillose near base; *column* green, anther with arms on each side of it yellow, arms as tall as anther; column-foot flushed with purple, with a free curved end bearing the lip.

TYPE: Cameron Highlands, 4800 ft. alt., leg. Holttum, August 1946.

***Calanthe cleistogama* Holtt., sp. nov.**

*Folia* ignota; flores non aperti; *sepala* viridi-flavescentia, c. 8 mm. longa,  $3\frac{1}{2}$  mm. lata, brevissime mucronata; *petala* similia, flavescentia, leviter breviores; labellum flavum, 9 mm. longum, calcare incluso; calcar 2.5 mm. longum; lamina labelli 4 mm. longa, integra, valde concava, apice marginibus elevatis,  $3\frac{1}{2}$  mm. lata, breviter acuta; *gynostemium* album.

TYPUS: Fraser's Hill, leg. C. E. Carr.

The above description is based on flowers in alcohol and colour notes made by the collector. The only other Malayan species of *Calanthe* with flowers of comparable size is *C. Foerstermannii*.

***Calanthe johorensis* Holtt., sp. nov.**

*Folii* lamina ad 70 cm. longa, 8 cm. lata, petiolus cum vagina c. 20 cm. longus; scapus c. 80 cm. longus, rachis ad 30 cm., multiflora; bracteae c. 2.5 cm. longae, caducae; pedicellus cum ovario c. 1 cm. longus; flores albi; *sepala* 1 cm. longa, 5 mm. lata, breviter acuta, *petala* 4 mm. lata, oblonga, obtusa; calcar labelli 11 mm. longum, rectum, clavatum, angulum  $30^\circ$  cum ovario faciens; lamina labelli trilobata, lobi laterales parvi, auriculiformes, ad basin laminae positi, lobus intermedius oblongus, c.  $4\frac{1}{2}$  mm. longus et  $2\frac{1}{2}$  mm. latus, basin versus costis 3 haud elevatis instructus, apicem versus reflexus, leviter concavus, apice bilobus, lobi rotundati,  $\frac{1}{2}$  mm. longi.

TYPUS: Johore, G. Panti, leg. C. E. Carr, November 1932.

The very long inflorescence of pure white flowers is distinctive among Peninsula species of *Calanthe* with caducous bracts.

***Camarotis adnata* (Ridl.) Holtt., comb. nov.**

Basinum: *Sarcochilus adnatus* Ridl., J. Linn. Soc. 32: 373. 1896.

Synonym: *Saccolabium adnatum* Ridl., Flora Mal. Pen. 4: 174. 1924.

I have examined the type specimen; it is undoubtedly a *Camarotis*, and distinct from all other species known to me.

**Coelogyne (§ Longifoliae) stipitibulbum** Holtt., sp. nov.

*Pseudobulbi* 2–3 cm. dissiti, ad 6 cm. longi,  $2\frac{1}{4}$  cm. lati, basi stipitiformes, supra medium dilatati, obtuse 4–angulati, demum longitudinaliter corrugati; *folia* 2, ad 15 cm. longa et 3 cm. lata, basi in petiolum 2 cm. longum angustata, margine crispata; *scapus* 6–10 cm. longus, compressus, 2– $2\frac{1}{2}$  mm. latus, rachis demum 30 cm. vel ultra longa, internodia c. 10 mm. longa, bracteae 2.5–2.8 cm. longae; *flores* omnino pallide salmonei; *sepalum dorsale* 2.6–2.9 cm. longum, 10 mm. latum; *petala* 2 mm. lata; *labellum* 2.3 cm. longum, lobi laterales erecti, antice breviter rotundati, quam lobo intermedio multo breviores, lobus intermedius 1.5 cm. longus, 8 mm. latus, leviter convexus, anguste ellipticus, apice acutus, carinis duabus levibus humilibus usque ad dimidium lobi extensis instructus; *gynostemium* quam lobis lateralibus labelli brevius, apice late alatum, truncatum.

TYPE: Cameron Highlands, S.F.N. 23284, leg. Holttum & Henderson.

This species is closely allied to *C. carnea*, but differs in stalked pseudobulbs thickened in the upper half, larger flowers with differently shaped midlobe and proportionately shorter sidelobes and column.

**Corybas caudatus** Holtt., sp. nov.

*Folia* cordata, acuta, c. 18 mm. longa et 12 mm. lata, pallide viridia, margine non crispata; *flos* c. 2 cm. alta, ovario 4 mm. longo incluso; *sepalum dorsale* album, rubro-striatum, basi erectum, 3 mm. latum, apicem versus horizontale, leviter cucullatum, 7 mm. latum, apice rotundatum, in caudam 3–4 mm. longam abrupte productum, margine prope caudam leviter irregulariter dentatum; *sepala lateralia* petalaeque rubra, basin versus alba, 3–3.5 cm. longa; *labellum* album, rubrostriatum, basi erectum, marginibus cucullum sepalis dorsalibus fere attingens, medio abrupte recurvum, margine alba fimbriata fere circum formante, 15 mm. latum, fimbriae ad  $2\frac{1}{2}$  mm. longae; *calcaria* 4 mm. longa, supra rubra.

TYPUS: G. Tahan, leg. E. J. H. Corner, 1937.

This species is similar to *C. pictus* in its long lateral sepals and petal, but differs in (1) leaf not crisped, (2) caudate apex of dorsal sepal, (3) longer fringe on the lip.

**Cystopus macranthus** (Hk. fil.) Holtt., comb. nov.

Basinym: *Odontochilus macranthus* Hk. f., F.B.I. 6: 98. 1890. Ic. Pl., t. 2161.

Synonym: *Anoetochilus macranthus* Ridl., Mat. Fl. M.P. 1: 215. 1907.

As pointed out by Ridley, this species is a true *Cystopus*, which genus is maintained by J. J. Smith, being distinguished from *Anoectochilus* by having the two stigmas united. *C. macranthus* differs from most species of *Cystopus* by lacking a toothed flange on either side of the claw of the lip.

***Cystorchis gracilis* (Hk. f.) Holtt., comb. nov.**

Basynym: *Goodyera gracilis* Hk. f., F.B.I. 6: 112. 1890.  
Ic. Pl. t. 2183.

In typical *Cystorchis* the spur of the lip has a vesicle on each side at the base, each vesicle containing a gland. In *C. gracilis*, the spur is not elongated beyond the vesicles, which coalesce, giving a saccate structure containing two glands, as in *C. aberrans* J.J.S. (Bull. Buitenz. Ser. 3, 5: 22. 1922), which may be conspecific with *C. gracilis*. Otherwise the flowers are like *Cystorchis*, not like *Goodyera*, which has hairs in the base of the lip.

***Dendrobium* (§ *Calcarifera*) *brinchangensis* Holtt., sp. nov.  
Fig. 3.**

*Pseudobulbi* ad 70 cm. longi, internodia 2–2½ cm. longa; folia maxima 13 cm. longa, prope basin 16 mm. lata, apicem versus sensim angustata, vaginae purpureo-suffusae; inflorescentiae flores 1–3 ferentes; flores pallide lilacini, labello maculo flavo medio ornato; sepalum dorsale 12 mm. longum, 6 mm. latum; mentum 12 mm. longum, fere rectum; petala 12 mm. longa, 4½ mm. lata, acuta; labellum cum apice pedis gynostemii junctum, calcar 5 mm. longum faciens, pars libera labelli 17 mm. longa, fere plana, lamina quam ungue paullo latior, 4½ mm. lata, apice abrupte angustata, obtusa, basi carinis 2 humilibus V-forme convenientibus instructa, conjunctio carinarum leviter elongata, libera, in ore calcaris posita.

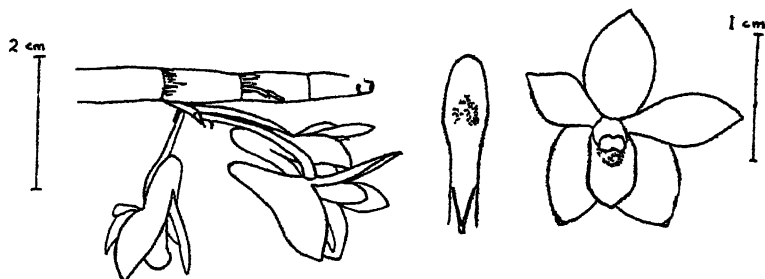


Fig. 3. *Dendrobium brinchangensis*: end of pseudobulb with one inflorescence; upper surface of free part of labellum; flower in face view.

TYPE: G. Brinchang, Cameron Highlands, S.F.N. 23533, leg. Holttum.

Allied to *D. cornutum* Hk. f. but differing in colour, in the equal length of upper sepal and mentum, the nearly flat lip with abrupt apex and longer closed spur. Found on three occasions on G. Brinchang, where it is common at 5500–6000 ft., flowering in April, August and December.

**Dendrobium** (§ *Conostalix*) **melanochlamys** Holtt., nom. nov.

*D. villosulum* Wall. apud. Hk. f., F.B.I. 5: 728. 1890.  
(Not *D. villosulum* Lindl. 1852).

**Dendrochilum** Blume.

It is now usual to unite *Platyclinis* with this genus. Some of Ridley's species of *Platyclinis* have not yet been transferred to *Dendrochilum*: the necessary new combinations are proposed below.

**Dendrochilum carnosum** (Ridl.) Holtt., comb. nov.

Basynym: *Platyclinis carnosa* Ridl., Journ. F.M.S. Mus. 6: 56. 1915.

**Dendrochilum gramineum** (Ridl.) Holtt., comb. nov.

Basynym: *Platyclinis graminea* Ridl., Journ. F.M.S. Mus. 6: 57. 1915.

**Dendrochilum lineare** (Ridl.) Holtt., comb. nov.

Basynym: *Platyclinis linearis* Ridl., J. Linn. Soc. 32: 230. 1896.

**Eria** (§ *Hymeneria*) **clavata** Holtt., sp. nov.

*Pseudobulbi* c. 4 cm. longi, 1 cm. diam., 2-foliati; folia c. 7 cm. longa, 1.4 cm. lata; inflorescentia erecta, 4 cm. longa, flores 8 ferens; bracteae pallide virides, 8 mm. longae, 4 mm. latae; sepala petalaeque alba, apice pallide rubra; *sepalum dorsale* 8 mm. longum, 3½ mm. latum; *sepala lateralalia* cum pede gynostemii mentum 4 mm. longum formantia, mentum angulum 60° cum ovario faciens; *labellum* trilobatum, pallide rubrum, lobis lateralibus carinisque atropurpureis, latere visum e basi ad apicem curvatum, carinis 3 basin versus donatum, carina media in lobum intermedium producta, in callo parvo semiorbiculare terminata; lobus intermedius apice recurvus, leviter emarginatus, medio carnosus, papillosus, parte carnosus basin versus ampliata, ad basin labelli producta.

TYPUS: Fraser's Hill, leg. C. E. Carr, 1929.

In habit this species resembles *E. Maingayi*, but differs in broader leaves and different colour and shape of flowers.

*Habenaria sumatrana* Schltr., var. *major* Holtt., var. nov.

A speciei typica differt: floribus majoribus; sepalis petalisque 7–8 mm. longis; labello 12 mm. longo, basi viride 6 mm. longa et 3 mm. lata, lamella alba abrupte ampliata, 12 mm. lata, 3-lobata, lobis lateralibus angulo 60° patentibus. rhomboideis, 4 mm. latis, margine leviter dentatis, lobo intermedio obtuso, 2 mm. longo, 1 mm. lato, calcare 3 mm. longo.

This variety is rather common in open places in Kedah. It should perhaps rank as a separate species; but further information about the variation of *H. sumatrana* is needed before this can be decided. The form of *H. sumatrana* described from Java by J. J. Smith seems to be larger than that common in Malaya, and perhaps comes between the latter and var. *major*.

*Kuhlhasseltia Carrii* Holtt., sp. nov.

*Planta* florens c. 18 cm. alta; lamina folii c. 4 cm. longa, 14 mm. lata, elliptica, acuta, petiolus cum vagina 16 mm. longus; scapus 11 cm. longus, breviter pubescens, bracteas steriles 3, ad 4 cm. longas, ferens; rachis brevis, flores 3 ferens; bracteae ad 9 mm. longae, marginibus hirsutis, cetera glabrae; ovarium c. 10 mm. longum, pubescens; *sepalum dorsale* 8 mm. longum, glabrum; *sepala lateralialia* basin labelli amplectentia; *petala* angusta, sepalo dorsali agglutinata; labellum 8 mm. longum, basi saccata 15 mm. alta, lamella bilobata, lobi patentes, 2½ mm. longi, 13 mm. lati.

TYPUS: Fraser's Hill, leg. C. E. Carr, November 1930.

This has larger flowers than the other species of the genus, and much larger leaves.

*Liparis* (§ *Platystylis*) *hirundo* Holtt., sp. nov. Fig. 4.

*Pseudohulbi* ovoidei, c. 6 mm. alti, 2-foliati; folii lamina ad 2 cm. longa, 5 mm. lata, elliptica, acuta, petiolus cum vagina infra articulum ad 6 mm. longus; inflorescentia ad 7 cm. longa, tenuissima, scapus brevis, anguste alatus; rachis anguste alata, flores c. 5 mm. dissiti, bracteae 2–3 mm. longae; pedicellus cum ovario 5–6 mm. longus; *sepala* 3½ mm. longa, marginibus revolutis; *sepala lateralialia* post labellum adjacentia, pro parte adjuncta; *petala* angustissima haud 2½ mm. longa, reflexa; labellum 2½ mm. longum, basi ad gynostemium adpressum, carnosum, antice excavatum, cetera angulum 90° cum gynostemio faciens, prope basin abrupte ampliatus, fere oblongum, angulis basalibus leviter productis et recurvis, apice brevissime

acutum; *gynostemium*  $2\frac{1}{2}$  mm. longum, curvatum, utroque latere alatum, prope stigma alis duabus angustis  $1\frac{1}{2}$  mm. longis reflexis, antice infra apicem alis duabus brevibus late triangularibus donatum.

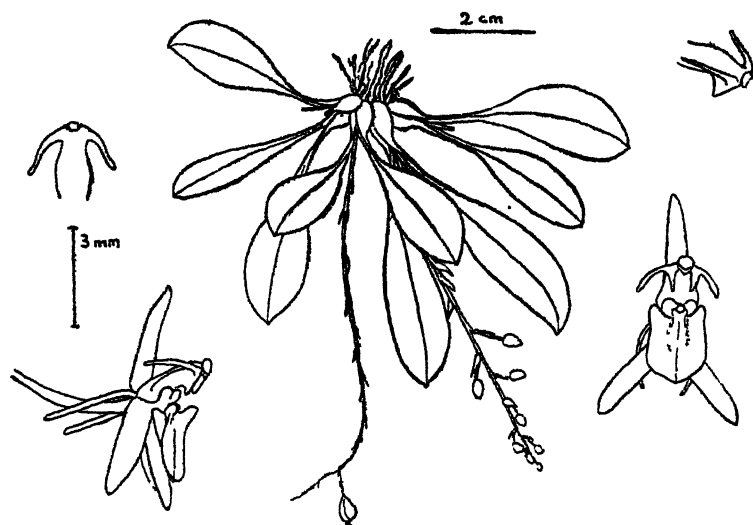


Fig. 4. *Liparis hirundo*: plant in natural position; flower in front and side view; column from back and side.

TYPUS: Cameron Highlands, leg. Batten-Pooll, 1939-40.

This species is related to *L. decurrens* and a few others of Java, Sumatra and the eastern Himalayas, but none of them are so small, and none have the long wings on each side of the stigma. These wings are spreading and curved backwards, and in that position have the shape of a swallow's wings in flight, the anther representing the head of the bird and the front column-wings its breast. The flowers are a pale salmon-pink, the lip deeper in colour than the rest. The leaves are pale green, and the plants hang from the branches of trees beside small forest streams in sheltered places.

#### Malaxis Soland.

It is now usual to include *Microstylis* Nutt. in *Malaxis*. Some species of the Peninsula need transferring to the latter genus, and the new names are proposed below.

#### *Malaxis macrochila* (Rolfe) Holtt., comb. nov.

Basynym: *Microstylis macrochila* Rolfe, Kew Bull. 1895: 6.

**Malaxis nemoralis** (Ridl.) Holtt., comb. nov.

Basinym: *Microstylis nemoralis* Ridl., J. Str. Br. R.As.  
Soc. 54: 47. 1910.

**Malaxis perakensis** (Ridl.) Holtt., comb. nov.

Basinym: *Microstylis perakensis* Ridl., J. Linn. Soc.  
32: 222. 1896.

**Malaxis reniloba** (Carr) Holtt., comb. nov.

Basinym: *Microstylis reniloba* Carr, Gard. Bull. S.S.  
7: 5. 1932.

**Malaxis stenophylla** Holtt., sp. nov.

*Pseudobulbi* c. 1 cm. alti, folia c. 6 ferentes; folia maxima 6 cm. longa et 6 mm. lata, apicem versus angustatus, marginibus leviter crispata, basi vaginata, vagina 10 mm. longa; inflorescentia ad 12 cm. alta, tenuis, scapus ad 5 cm. longus; flores 3–5 mm. dissiti, simul aperti, pauci; bracteae  $3\frac{1}{2}$  mm. longae, pedicelli cum ovariis 4–5 mm. longi; sepalum 2 mm. longa, lata; petala valde angustiora; labellum totum  $2\frac{1}{2}$  mm. longum, fere  $2\frac{1}{2}$  mm. latum, 3-lobatum, lobi magnitudine fere aequales; lobi laterales elliptici, obliqui, post gynostemium in auriculis rotundatis brevibus producti; lobus intermedius cordatus, apice breviter bidentatus, dentes leviter incurvi, sinus rotundatus; gynostemium breve, alis brevibus donatum.

TYPUS: Trengganu, G. Padang, alt. 4000 ft., S.F.N. 33932, leg. Moysey.

This species is probably nearest to *M. calophylla*, but has very narrow leaves, and a distinctly trilobed lip. The shape of the side-lobes is nearly as in *M. reniloba* (Carr), but the whole lip is much smaller in *M. stenophylla* and the midlobe proportionately much larger than in *M. reniloba*. No colours of the flowers were recorded.

**Malleola altocarinata** Holtt., sp. nov.

*Caulis* brevis, pendulus; folia pauca, c. 8 cm. longa, 2.5 cm. lata, oblanceolata, apice obtusa inaequaliter bilobulata; inflorescentia c. 10 cm. longa, pendula, multiflora; flores 8 mm. longi; sepalum dorsale supra gynostemium cucullatum, c. 4 mm. longum,  $2\frac{1}{2}$  mm. latum; sepalum lateralia patentia, 4 mm. longa,  $2\frac{1}{2}$  mm. lata; petala  $3\frac{1}{2}$  mm. longa, haud 2 mm. lata, acuta; tabellum ovarium versus reflexum; lobi laterales carnosii, humiles, rotundati, leviter patentes; lobus intermedius anguste triangularis, carnosus, apice reflexus, 2 mm. longus, basi alto-carinatus, carina supra ostium calcaris elevata, basi utroque latere ad lobos laterales juncta; calcar sub ostio primo late cylindricum,

3 mm. longum et 2 mm. latum, demum constrictum, apice fere globosum, 1 mm. diam., intus postice callo parvo instructum; *gynostemium*  $1\frac{1}{2}$  mm. altum.

TYPUS: Ginting Simpah, Selangor, leg. Mungo Park, October 1932.

This is allied to *M. aberrans* from Celebes and *M. baliensis* from Bali and Java; all agree in having a high keel at the base of the midlobe of the lip.

**Malleola macranthera** (Ridl.) Holtt., comb. nov.

Basinym: *Saccolabium macrantherum* Ridl., Kew Bull. 1926: 478.

Synonym: *Abdominea macranthera* Carr, Gard. Bull. S.S. 7: 54, pl. 5B. 1932.

I think Carr was mistaken in including this species in *Abdominea*. The large rostellum of *Abdominea minimiflora* (Hk. f.) J.J.S. has a narrow base and is quite different in shape from that of *Saccolabium macrantherum* Ridl. *Abdominea* also has four pollinia, and a lip of quite different shape. The column and spur of *S. macrantherum* agree quite well in shape with species of *Malleola*, and the stipes of the pollinia also.

**Oberonia calcicola** Holtt., sp. nov.

*Caules* brevissimi, folia c. 6 ferentes; folia flabelliforme patentia, maxima 5.5 cm. longa, 9 mm. lata, fere recta, e basi lata sensim angustata, apice breviter acuta; inflorescentia c. 10 cm. longa, erecta vel apice nutans, scapus c. 1 cm. longus; flores in verticillis c. 6-floribus dispositi, verticilli 2 mm. dissiti; bracteae 2 mm. longae, fere integrae; sepala petalaeque integra; sepala reflexa, late ovata, lateralia quam dorsale latiora; petala anguste oblonga; labellum petalis aequilongum, basi carnosum, 3-lobatum; lobi laterales parvi, breves, fere quadrangulares, integri; lobus intermedius oblongus, e basi paullo ampliatus, apice bilobatus, lobuli angusti, acuti, breves, sinus latus.

TYPUS: Langkawi, S.F.N. 21398, leg. Henderson. The flower on the only specimen is old and the details of the lip uncertain.

**Oberonia flabellifera** Holtt., sp. nov.

*Caules* ad 2.5 cm. longi, leviter sinuati, 3-5-foliati; folia angulum infra  $45^\circ$  cum caule facientia, supra basin vaginata c. 1.5 cm. longa,  $2\frac{1}{2}$  mm. lata, oblonga, breviter acuta; inflorescentia ad 7 cm. longa, scapus 10 mm.; flores in verticillis c. 7-floribus dispositi, verticilli 3-4 mm. dissiti; bracteae breves, latae, margine minute papillosae; pedicellus cum ovario 1 mm. paullo superans; sepala petalaeque pallide flavescentia, omnia patentia, aequilonga, flos totus  $1\frac{1}{2}$  mm.

latus; *sepala* late ovata, fere aequalia, integra, sepalum dorsale obtusum, lateralia acuta; *petala* quam dimidium sepali paullo latiora, obovata, margine irregulariter dentata; labellum ochraceum, petalis aequilongum, circumscriptione fere semiorbiculare, 3-lobatum; lobus intermedius angustus, apicem versus ampliatus, apice plus minusve emarginatus; lobi laterales flabelliformes, profunde incisi, dentes basin labelli versus decrescentes.

TYPUS: Johore, Mawai, S.F.N. 28162, leg. E. J. H. Corner.

Also found on old mangrove in Singapore. The side-lobes of the lip almost meet the midlobe, which is not very distinct; otherwise the lip is very like that of *O. stenophylla*, but the leaves are very short and the apices of the sepals not deflexed.

***Oberonia transversiloba* Holtt., sp. nov.**

*Caules* c. 45 cm. longi, c. 6-foliati; *folia* cum caule angulum parvum facientia, fere recta, apicem versus leviter incurva. acuta, prope basin valde articulata, supra articulum c. 9.5 cm. longa, 5 mm. lata; inflorescentia erecta, ad 16 cm. longa, scapus 6 cm.; *flores* in verticillis c. 6-floribus dispositi, verticilli  $2\frac{1}{2}$ –3 mm. dissiti; bracteae integrae; pedicellus cum ovario 2 mm. longus; sepalum dorsale petalaeque patentia, integra, fere aequalia; petala tamen apice angustiora; sepala lateralia latiora, reflexa; labellum aurantiaco-flavum, 3-lobatum, petalis aequilongum, fascia humile e basi fere ad apicem donatum; lobi laterales parvi, rotundati; lobus intermedius transverse oblongus, marginibus leviter et irregulariter dentatis.

TYPUS: Pahang, Gua Tipus, S.F.N. 19448, leg. M. R. Henderson.

***Octarrhena condensata* (Ridl.) Holtt., comb. nov.**

*Oberonia condensata* Ridl., Journ. Linn. Soc. 38: 322. 1908.

I have collected fresh specimens of this species at Cameron Highlands and compared them with the type. This species is much larger than *Octarrhena parvula*, with stems to 20 cm. long, leaves to 3.5 cm. long and 5 mm. wide, much flattened laterally, and crowded flowers of a deeper yellow colour.

***Pennilabium acuminatum* (Ridl.) Holtt. comb. nov.**

Basynym: *Sarcochilus acuminatus* Ridl., Journ. F.M.S. Mus. 4: 72. 1909.

I have examined the type of this species; it is certainly a *Pennilabium*.

**Phaius longipes** (Hk. f.) Holtt., comb. nov.

Basinym: *Calanthe longipes* Hk. f., F.B.I. 6: 195. 1890.

Oldest name: *C. gracilis* Lindl., Gen. et Sp. Orch 251. 1833. (Not *Phaius gracilis* Hayata 1911).

Though aberrant in the genus *Phaius*, this species, with column and lip not joined together, appears to me better placed in *Phaius* than in *Calanthe*.

**Phaius pauciflorus** Bl., Mus. Bot. 2: 181. 1852. (*Limatodis* Bl. 1825), var. *pallidus* (Ridl.) Holtt., stat. nov.

Basinym: *Phaius pallidus* Ridl., Journ. Linn. Soc. 32: 313. 1896.

Synonym: *Limatodis pallidus* Ridl., Fl. Mal. Penin. 4: 124. 1924.

Three varieties of *P. pauciflorus* have been described in Java and Sumatra (see J.J.S. in Fed. Rep. 32: 238 for synonymy). The Malay Peninsula plants appear to me to come within the range of the species so interpreted, but are slightly different from var. *sumatranus*.

**Phalaenopsis decumbens** (Griff.) Holtt., comb. nov.

Basinym: *Aerides decumbens* Griff., Notul. 3: 365. 1851. Ic. t. 320.

Synonyms: *Kingiella decumbens* Rolfe, Orch. Rev. 25: 197. 1917. Ridl., Flora 4: 158.

*Phalaenopsis wightii* Rchb. f., Bot. Zeit. 1862: 214.

*Doritis wightii* Benth., Gen. Plant. 3: 574. 1883.

King & Pantl., Ann. Calc. 8: 198, t. 265.

*Phalaenopsis hebe* Rchb. f., Hamb. Gartenz. 18: 35. 1862. J.J.S., Fl. Buit. 6: 550, fig. 417.

I can see no clear distinction between Pantling's illustration of *Doritis wightii* and J. J. Smith's of *Phalaenopsis hebe*. I agree with J. J. Smith in referring this species to *Phalaenopsis*, and it appears that Griffith's is the oldest name.

**Pholidota longibulba** Holtt., sp. nov.

*Pseudobulbi* 1–2 cm. dissiti, 7–9 cm. longi, prope basin 15–20 mm. lati, apicem versus sensim attenuati, valde angulati, laeves, unifoliati. Lamina folii ad 30 cm. longa et 5–5 cm. lata, oblanceolata, apice breve acuminata, venae primariae 5, petiolus  $2\frac{1}{2}$ –4 cm. longus. Inflorescentia cum folio immaturo in apice pseudobulbi immaturi explicata: scapus tandem 18 cm. longus, haud 1 mm. diametro, erectus; rachis ad 18 cm. longa, nutans, flexuosa, internodia c. 4 mm. longa; bractae deciduae, 9 mm. longae, 5 mm. latae, ellipticae, apice rotundatae; pedicelli nulli, ovarium  $2\frac{1}{2}$  mm. longum. *Sepalum dorsale*  $4\frac{1}{2}$  mm. longum,  $3\frac{1}{2}$  mm. latum. ovatum, apice rotundatum, concavum; *sepala lateralia* 5 mm.

longa, valde carinata, concava. *Petala*  $3\frac{1}{2}$  mm. longa, 2 mm. lata, ovata, acuta. *Saccus labelli*  $3\frac{1}{2}$  mm. longus,  $2\frac{1}{2}$  mm. latus, intus 3-venulosus, venulis non carinatis, antice lobum unicum ferens; lobus recurvatus, explicatus reniformis,  $3\frac{1}{2}$  mm. latus, 2 mm. longus, basi callo leviter bilobo cum sacco junctus. *Gynostemium* 2 mm. longum,  $1\frac{1}{2}$  mm. latum; rostellum fere erectum; alae laterales angustae, lobo parvo triangulo prope stigma instructae; ala apicalis brevis, truncata; anthera fere horizontalis, explicata 1.7 mm. lata, 1.3 mm. longa.

TYPUS: Pahang, Cameron Highlands, 4800 ped. alt., leg. Holttum, Aug. 1946.

***Pomatocalpa setulense* (Ridl.) Holtt., comb. nov.**

Basinym: *Saccolabium setulense* Ridl., J.S.B.R.A.S. 59: 198. 1911.

I have examined the type of this species; it is a *Pomatocalpa*, as defined by J. J. Smith.

***Rhynchostylis gigantea* (Lindl.) Ridl., var. *Harrisoniana* (Hk.) Holtt.**

Basinym: *Saccolabium Harrisonianum* Hk., Bot. Mag. t. 5433. 1864.

It appears to me that Hooker's species is no more than a colour variety of *R. gigantea*.

***Sarcanthus capricornis* (Ridl.) Holtt., comb. nov.**

Basinym: *Ascochilus capricornis* Ridl., Flora Mal. Penin. 4: 181. 1924.

I have examined the type of this species at Kew. It is undoubtedly a *Sarcanthus*, and appears to be distinct from any other species already described, though very near to the Siamese *S. recurvus* Downie, which has a larger inflorescence and smaller flowers. The following is a revised description.

*Stems* to about 15 cm. long, internodes about 5 mm. long; leaves  $2\frac{1}{2}$ –4 cm. long, terete, strongly recurved, acute, about 3 mm. thick; inflorescences about 6 cm. long including the scape of barely 1 cm.; bracts 1 mm. long, 3 mm. apart; pedicel and ovary 8 mm. long; *upper sepal* nearly 4 mm. long; *petals* about 3 by  $1\frac{1}{2}$  mm.; lip with saccate non-septate spur  $1\frac{1}{2}$  mm. long and wide, erect broadly rounded side-lobes 2 mm. long and wide, narrowly triangular mid-lobe 3 mm. long and 2 mm. wide, with short hairs at the entrance to the spur, and a thick bluntly triangular backcallus; column-foot about 2 mm. long. "Upper petal (*i.e.*, sepal) magenta, lower petals brownish green mottled with red" (collector's note).

**Sarcanthus inflexilobus** Holtt., sp. nov.

*Caulis* 5 cm. longus, c. 10-foliatus; *folia* ad 16 cm. longa et 1 cm. lata, carnosa, apice sensim angustata, bilobulata, obtusa, infra valde carinata; inflorescentia simplex vel ramulis 1-2 instructa, ad 15 cm. longa; scapus 5 cm. longus; *sepalum dorsale* 3 mm. longum,  $1\frac{1}{2}$  mm. latum, obtusum; *petala*  $2\frac{1}{2}$  mm. longa, haud 1 mm. lata; labellum ex apice calcaris ad apicem lobi intermedii 6 mm. longum; calcar anguste conicum, 3 mm. longum, prope apicem solum longitudinaliter septatum; lobi laterales horizontaliter inflexi, in medio ostii calcaris fere congregientes; callus ad basin gynostemii T-formis (antice visus), capite supra ostium calcaris elevato, basi in lacunam inter lobos laterales descendens; lobus intermedius concavus, non callosus, sagittatus,  $2\frac{1}{2}$  mm. longus et latus, lobulis basalibus angustatis, acutis, elevatis, apice obtusa leviter reflexa.

TYPUS: Gua Musang, Kelantan, August 1929, leg. C. E. Carr.

**Sarcanthus ionosmus** (Ridl.) Holtt., comb. nov.

Basinym: *Cleisostoma ionosmum* Ridl., Journ. Linn. Soc. 32: 336. 1896 (not of Lindley).

Synonym: *Saccolabium ionosmum* Ridl., Mat. Fl. Mal. Penin. 1: 170. 1907.

I have examined the type of this species.

**Sarcanthus lanatus** (Lindl.) Holtt., comb. nov.

Basinym: *Cleisostoma lanatum* Lindl., Journ. Hort. Soc. 4: 164. 1849.

Synonym: *Sarcanthus bracteatus* Ridl., J. Linn. Soc. 32: 370. 1896.

I have examined the type of Ridley's species, and find it to agree with *Saccolabium lanatum* Hk. fil., as figured in Ann. Calc. 5, t. 72. It is peculiar in its hairiness, but seems to be a true *Sarcanthus* in flower-structure.

**Sarcanthus rugulosus** (Ridl.) Holtt., comb. nov.

Basinym: *Saccolabium rugulosum* Ridl., J.S.B.R.A.S. 39: 82. 1903.

I have examined the type of this species.

**Sarcochilus carrii** Holtt., sp. nov.

*S. siamensis* sensu Carr, Gard. Bull. S.S. 5: 31, pl. XI, B (1929), non *Ascochilus siamensis* Ridl., Journ. Linn. Soc. 32: 375. 1896.

*Caules* brevissimi, c. 5-foliati; *folia* ad 4 cm. longa, 12 mm. lata; scapus tenuis, minute asperus, erectus, quam folia brevior; rachis brevis, bracteae brevissimae; flores pallide flavescentes, labellum album; *sepala* c.  $3\frac{1}{2}$  mm. longa, lateralia 2 mm. lata, dorsale angustius; *petala* 3 mm. longa, haud 1 mm. lata; labellum ecalcaratum, dorso lineam

pedis gynostemii continuans, 3 mm. longum; lobi laterales oblique erecti, obovati, apice rotundati, postice  $2\frac{1}{2}$  mm. longi, 1.2 mm. lati; lobus intermedius valde carnosus, antice visus oblongus, breviter acutus, sectione longitudinale triangularis; *gynostemium* c. 1.2 mm. longum; pes gynostemii aequilongum, cum gynostemio angulum  $90^\circ$  faciens.

TYPUS: Mentakab, Pahang, leg. C. E. Carr.

This species resembles the true *S. siamensis* (Ridl.) Carr in general appearance and colouring, but has no spur. Carr correctly showed that the two species were distinct and figured them both; but he evidently did not carefully examine the type of *Ascochilus siamensis*, which agrees with the specimen he named *S. mentakabensis*. The specimen figured by him as *S. siamensis* therefore needs a new name and diagnosis.

***Sarcochilus johorensis* Holtt., sp. nov.**

*Caulis* brevis, c. 5-folius; *folia* ad 8 cm. longa, 15 mm. lata, obtusa; scapus 3 cm. longus, asperulus; rachis 1 cm. vel ultra longa, incrassata; flores conferti; bracteeae 2 mm. longae, latae, obtusae; pedicellus cum ovario c. 8 mm. longus; sepala petalaeque pallide sordide flavescentia; sepala extus breviter hirsuta; *sepalum dorsale* 11 mm. longum 5 mm. latum, obovatum, acutum; *sepala lateralia* brevissime ad pedem gynostemii juncta; *petala* 10 mm. longa,  $3\frac{1}{2}$  mm. lata; labellum 7.7 mm. longum, fere lineam pedis gynostemii continuans (calcar leviter inflexum); lobi laterales sordide rufobrunnei, erecti, rotundati, apicem versus ampliati,  $2\frac{1}{2}$  mm. lati; lobus intermedius carnosus, supra calcar sedens,  $2\frac{1}{2}$  mm. longus, 2 mm. altus, lateraliter compressus, apicem versus elevatus, antice angulum  $90^\circ$  cum calcare faciens; calcar quam lobus intermedius 3 mm. longius, rectum, cylindricum, 2 mm. diam., gynostemium  $6\frac{1}{2}$  mm. longum; pes gynostemii 5 mm. longum.

TYPUS: Johore, Sedili River, leg. C. E. Carr, October 1932.

***Sarcochilus minutiflorus* (Ridl.) Holtt., comb. nov.**

Basinym: *Ascochilus minutiflorus* Ridl., J.S.B.R.A.S. 39: 85. 1903.

Ridley's *Ascochilus* is not very sharply differentiated from *Sarcochilus* and I prefer to unite it with *Sarcochilus*.

***Thrixspermum scopa* (Hk. fil.) Holtt., comb. nov.**

Basinym: *Sarcochilus scopa* Hk. fil., F.B.I. 6: 40. 1890.

(*Thrixspermum arachnites* quoad Ridl., Flora M.P. 4: 185, p.p.).

This species appears to be distinct from *T. arachnites* (Bl.) Rchb. f. in its much longer stems (internodes 2.5 to

5 cm. long, as compared with 1 cm. in *T. arachnites*), but is very similar in its flowers. The two need to be cultivated side by side and critically compared.

**Thrixspermum (§ Dendrocolla) duplocallosum** Holtt., sp. nov. Fig. 5.

*Caulis* c. 4 cm. longus, paucifolius, internodia 4 mm. longa; *folia* c. 6 cm. longa, 11 mm. lata, non carnosae, apice bilobata, subtus purpurea; scapus purpureus, 4.5 cm. longus, rachis 8 mm. longa, bracteae 2 mm. longae, late triangulares, purpurascens; pedicellus cum ovario 5 mm. longus; sepalae petalaeque albae, leviter roseo-tinctae; *sepalum dorsale* 6½ mm. longum, 3¼ mm. latum, *sepala lateral*ia 4 mm. lata; petala 2¼ mm. lata; labellum *petalis* sepalisque aequilongum, glabrum, aurantiacum, callis duobus sordide sanguineis instructis, lobi laterales erecti, 2½ mm. alti, rotundati, antice non prominentes, lobus intermedius 2¼ mm. latus, semiorbicularis, reflexus, margine dentatus, callus anticus basi lobi intermedii positus, latus, medio depressus, antice bilobatus callus posticus longitudinaliter extensus, extremis utrisque breviter liberis; *gynostemium* album, 2½ mm. longum, pes gynostemii 2½ mm. longus, pallide purpurascens; capsula purpurea, 5½ cm. longa.

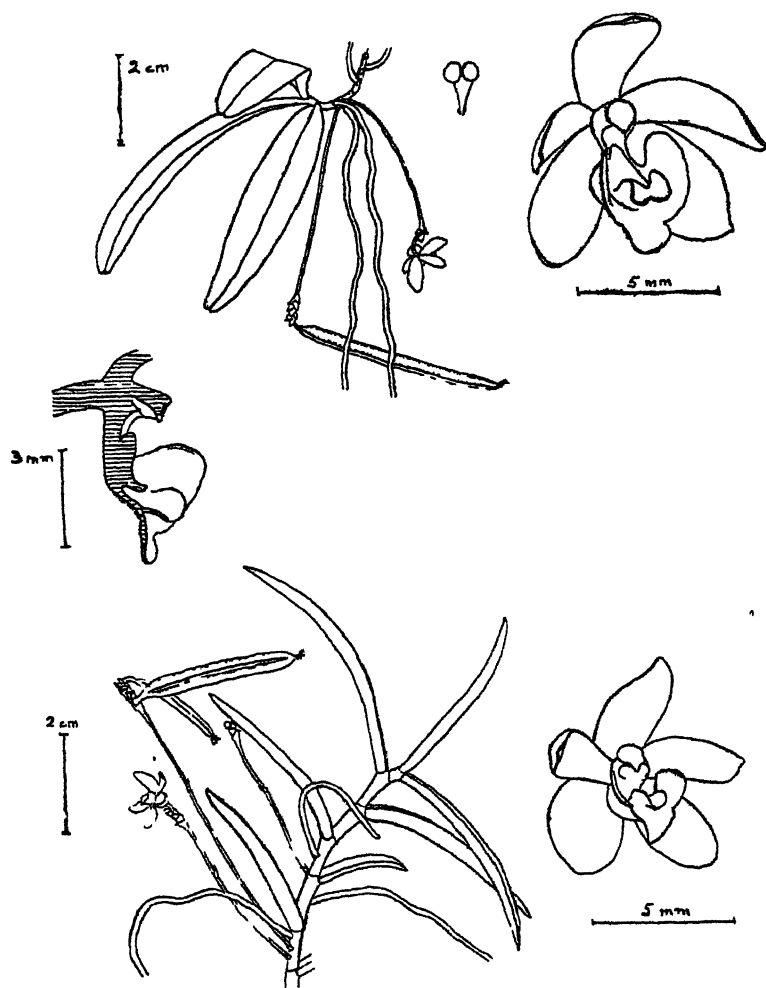
TYPUS: Cameron Highlands, 4,800 ft. alt., leg. Holtum August. 1946.

Found on a tree in valley forest near waterfall; described from living plant.

**Thrixspermum (§ Dendrocolla) brevicapsularis** Holtt., sp. nov. Fig. 5.

*Caulis* 18 cm. longus, multifolius, internodia 10 mm. longa; *folia* 4–5 cm. longa, 5–6 mm. lata, valde carnosae, apice anguste bilobatae, omnino purpureo-maculatae; scapus 4–6 cm. longus, rachis ad 10 mm. longa, cylindrica, bracteae 1 mm. longae, tenues, apice tantum eminentes, pallide virides; flores eis *T. duplocallosi* similes, different: *sepalis petalisque* leviter lutescentibus, labello flavo, medio aurantiaco, basi aurantiaco-striato, callo antico sordide aurantiaco, callo postico antice sordide purpureo, lobo intermedio triangulare, margine non dentato, apice acuto, capsula 3–3½ cm. longa, viride, leviter purpureo-maculata.

TYPUS: Cameron Highlands, 4,800 ft., on an old coffee bush in exposed place, leg. Holtum Aug. 1946. Described from living plant.



*Fig. 5.* (above) *Thrixspermum duplocallosum*: whole plant; flower; pollinia; longitudinal section of flower.  
(below) *T. brevicapsularis*: apical part of plant and a single flower.

**Thrixspermum (§ Dendrocolla) Corneri** Holtt., sp. nov.

*Caulis* brevis, c. 3-foliatus; *folia* teretia, ad 4 cm. longa, fere 3 mm. lata; scapus 10 mm. longus; rachis inflorescentiae incrassata, brevis; bractae latae, breves, breviter acutae; pedicellus cum ovario 5 mm. longus; flores pallide flavescences, labello pallide brunneo-maculato; *sepalum dorsale* 4½ mm. longum, 3 mm. latum, late acutum; *sepala lateralalia* late cum pede gynostemii juncta, 4 mm. lata; *petala* obovata, obtusa, 2½ mm. lata; labellum e basi gynostemii ad apicem lobi intermedi 4 mm. longum, ex apice loborum lateralium ad fundum sacci 7 mm. altum; lobi laterales erecti, late rotundati; lobus intermedius truncatus, carnosus, brevissime pilosus; callus bifidus; saccus intus e callo ad fundum fascia longe-pilosa instructus; *gynostemium* breve, pes gynostemii 2½ mm. longum.

TYPUS: Mawai, Johore, by Sedili River, leg. E. J. H. Corner. (Specimen preserved in alcohol).

**Thrixspermum platycaule** Holtt., nom. nov.

Basinym: *Sarcochilus anceps* Ridl., J.S.B.R.A.S. 54: 53. 1909. (Not *Thrixspermum anceps* (Bl.) Rchb.f.).

I have examined the type of this species; the lip is that of *Thrixspermum*, not *Sarcochilus*.

**Trichoglottis misera** (Ridl.) Holtt., comb. nov.

Basinym: *Saccolabium miserum* Ridl., Journ. Linn. Soc. 32: 359. 1896.

The type of this species has the usual tongue of *Trichoglottis* at the base of the column, but not the horns on either side of the column usually found in that genus; there is a fleshy thickening on either side of the rostellum.

**Uncifera tenuicaulis** (Hk. f.) Holtt., comb. nov.

Basinym: *Saccolabium tenuicaule* Hk. f., F.B.I. 6: 64. 1890.

This species differs from the others hitherto referred to *Uncifera* in having inflorescences of 1–3 flowers, the spur curved upwards in front, hairs within the spur, and the tip of the stipes not recurved. In other respects it agrees with the other species of *Uncifera*, and it appears not to be referable to any other genus at present recognized.

## CYPERACEAE

**Mapania cuspidata** (Miquel) Holtt., comb. nov.

Basynym: *Lepironia cuspidata* Miq., Fl. Ind. Bat. Suppl. 603. 1860.

Synonyms: *Lepironia humilis* Miq., Ill. Fl. Arch. Ind. 61, t. 21. 1871. (but not *Pandanophyllum humile* Miq. 1855).

*Mapania lucida* N.E. Br. in Ill. Hort. 32: 77, t. 557. 1885.

*M. triquetra* Ridl., Journ. Str. Br. R. Asiat. Soc. 41: 51. 1903.

*M. petiolata* var. *cuspidata* Uittien, Rec. Trav. Bot. Néerl. 33: 282. 1936.

This is perhaps not sharply distinct from *M. petiolata*, though extreme forms are very different. If the two are united, as by Uittien (l.c.), the name *cuspidata* must be used, being older. But I suggest maintaining them separate pending further field study.

**Mapania insignis** Holtt., sp. nov.

*M. inopinatae* Uittien affinis, differt foliis, scapis, spiculis multo majoribus.

*Leaf-sheaths* to 20 cm. long, petioles to 40 cm. long and 8 cm. wide, leaf-blades to 60 cm. long and 11 cm. wide, caudate apex to 15 cm. long. *Scape* 12–35 cm. long, 3–4 (–5?) mm. diameter, very shortly and densely rough-hairy throughout (almost as in *M. palustris*), rusty in appearance when dried, basal sheaths stiff, acute, to 8 cm. long. *Inflorescence* a head of 8–16 sessile spikelets, the whole 3½–6 cm. across, with stiff acute primary bracts to 3 cm. long. *Spikelets* 2–2½ cm. long, 1 cm. wide, the longer ones with acute apex. *Glumes* 9–11 mm. long, narrowly oblong with rounded apex, inner ones thin; *scales* as long as glumes, the lateral outer scales hairy on keels near apex only. *Nut* not seen.

*Typus*: Pahang, Gunong Tahan, 3,000 ft., S.F.N. 20584, leg. Holttum 27-8-1928. Also at same locality S.F.N. 8125 (Haniff & Nur) and Ridley 16192; and at Karak F.R., Pahang, S.F.N. 13883 (Best).

Like *M. inopinata*, this has the inflorescence of section *Halostemma* and the vegetative habit of *M. petiolata* C. B. Clarke which, on account of its simple spikelet, is placed in section *Pandanophyllum*. Clarke however reports (F.B.I. 6: 683) that *M. petiolata* (there called *M. humilis*) may have small secondary spikelets in the axils of the basal bracts, and so may other species, so that the distinction between the two sections is not a sharp one, and I doubt if it should be maintained. The group of *M. petiolata*

C. B. Cl., characterized by the petioled leaves, is however very distinct, and should perhaps constitute a separate section of the genus.

**Mapania micropandanus** Holtt., sp. nov.

*Caulis* erectus, radicibus rectis obliquis sustentus. *Folia* c. 30 cm. longa, 8–13 mm. lata, tenuia, pallida, basi leviter angustata et complanata, apice breviter et aequaliter angustata, non caudata, margine per totam longitudinem acute denticulata, *venae primariae* 3, media subtus laterales supra elevatae, omnes omnino denticulatae. *Scapus* brevissimus. *Spicula* florens 15 mm. longa, 5 mm. lata; *glumae* pallidae, tenues, 10 mm. longae, multinervosae, nervis concoloribus, in sicco leviter elevatis.

TYPUS: Johore, S. Kayu Ara, Mawai-Jemaluang Road, S.F.N. 29362, leg. E. J. H. Corner, 5th May 1935. Also Pulau Tioman, 1,000 ft., Burkill s.n. June 1915.

This little species, like a miniature Pandanus, occurs in dry Dryobalanops forest and in the drier parts of the (fresh-water) swampy forest in the Sedili River area, S.E. Johore. It is distinct from all other species in the shape and size of its leaves, which are in texture rather like those of *M. tenuiscapa* C. B. Cl. but shorter, shortly pointed, with only 3 main veins which are finely toothed on their raised surface almost from base to apex of the leaf (they are smooth in *M. tenuiscapa*).

**Scleria cyathophora** Holtt., sp. nov.

*Caules* approximati, fere 100 cm. longi,  $2\frac{1}{2}$ –3 mm. diametro, acute triquetri, laeves. *Folia* maxima fere 30 cm. longa, 5 mm. lata, apice longe acuminata, haud scaberula; *vaginae* angustae, non alatae, acute triquetrae, minute pilosulae, os liguliforme semirotundatum. *Inflorescentia* terminalis angusta, fere 12–15 cm. longa, ramo infimo interdum sejuncto incluso; bractae primariae inferae foliiformae, superiores parvae angustae; rami primarii adscendentes, non pedunculati, rami secundarii pauci, brevissimi. *Spiculae* rufobrunneae, 4 mm. longae, plerumque androgynae. *Antherae*  $2\frac{1}{2}$  mm. longae, anguste apiculatae. *Nux* haud 3 mm. longa, basi angusta, cetera ovoidea, versus apicem brevissime apiculatum obtuse triquetra, alba, lineis transversalibus irregularibus interruptis rufopuberulis instructa; *discus* cyathiformis, tenuis, pallide rufidulus, lobi lati, approximati, truncati, leviter et irregulariter dentati, fere ad medium nucis attingentes.

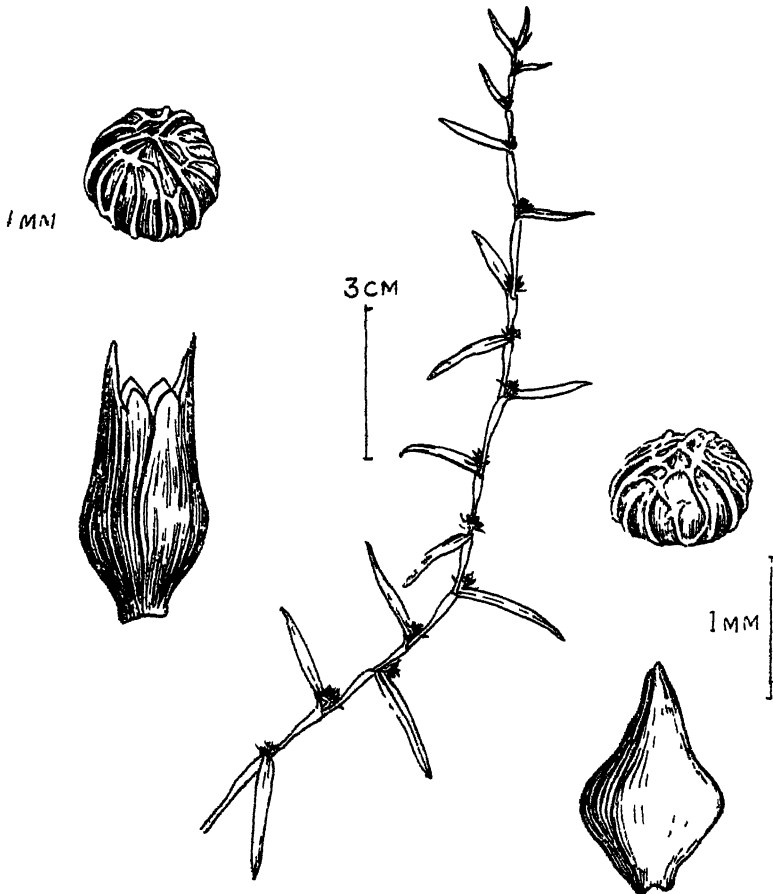
TYPUS: Pahang, Tasek Bera, S.F.N. 24042, leg. M. R. Henderson 14-10-1930 "in shallow water".

This is related to *S. Motleyi* C. B. Cl. (*S. gonocarpa* Ridl.), but is more slender, has much narrower leaves, and

the disc of the nut forms a cup nearly half the length of the nut. The shape and hairiness of the nut are almost as in *S. Motleyi*, but the upper part is less strongly angled and the apex slightly mucronate.

***Diplacrum reticulatum* Holtt., sp. nov. Fig. 6.**

Habitu et foliis *D. caricino* affinis, differt internodiis brevioribus, plerumque 1–1½ cm. longis, membranis orum vaginarum firmioribus. *Spiculae feminae* 2 mm. longae, turbinatae, fere 1½ mm. latae, apice leviter acuminatae; *glumae* ovatae acutae convexae, nucem amplectentes, in



**Fig. 6.** *Diplacrum reticulatum*, with female spikelet and nut on right. On left, female spikelet and nut of *D. caricinum*.

sicco rubro-punctatae, venulae haud distinctae. *Nux alba*, globosa, depressa, longitudine haud 1 mm., latitudine c.  $1\frac{1}{4}$  mm., tricarinata, inter carinas reticulata.

TYPUS: Pahang, Gua Tipus, Chigar Perah, S.F.N. 19411, leg. M. R. Henderson 15.10.1927; "in damp spot in lallang field". (Lallang is *Imperata cylindrica*).

This species is closely similar in habit to *D. caricinum*, but differs in its turbinate, not cylindric, female spikelets with entire glumes, and in the broader reticulate nut.

## GRAMINEAE

***Dendrocalamus dumosus* (Ridl.) comb. nov.**

*Schizostachyum dumosum* Ridl., Journ. Str. Br. R. Asiat. Soc. 61: 64. 1912.

The spikelets of this species are one-flowered, and in every essential agree with the one-flowered spikelets of *D. pendulus* Ridl. (which species has either one or two-flowered spikelets). The spikelets are entirely unlike *Schizostachyum*.

***Dendrocalamus elegans* (Ridl.) comb. nov.**

*Schizostachyum elegans* Ridl., Journ. Str. Br. R. Asiat. Soc. 73: 146. 1916.

The spikelets of this also agree very closely with those of *D. pendulus* Ridl., having one or two florets.

***Dendrocalamus sinuatus* (Gamble) comb. nov.**

*Oxytenanthera sinuata* Gamble, Ann. Calc. 7: 71, pl. 62. 1896.

I have stated the case for the union of *Oxytenanthera* with *Dendrocalamus* in Journ. Arn. Arb. 27: 340. 1946.

***Schizostachyum Ridleyi* (Gamble) comb. nov.**

*Ochlandra Ridleyi* Gamble, Ann. Calc. 7: 127, pl. 114. 1896.

In every respect except lodicules (of which there are 6-10), this species is extremely near to *S. latifolium* Gamble, which itself has 4 lodicules, and often basal parts of anthers winged as if in transition to lodicules. There is no evidence that *S. Ridleyi* has a large fruit, which is one of the characteristic features of *Ochlandra*; and *Ochlandra* is otherwise only known from southern India.

**Spodiopogon velutinus** sp. nov.

*Culmi* ad 300 cm. longi, procumbentes, 5–6 mm. diametro apicem versus; *folii lamina* vulgo 30 cm. longa, 4–4.5 cm. lata, apice acuminata, basi cuneata, infra molliter velutina, supra glabra, margine scabrida, basi pilis paucis longis albidis munita, costa pallida; *vagina* hirsuta vel fere glabra; *ligula* haud 1 mm. alta, glabra. *Panicula* c. 25 cm. longa, axis primarius hirsutus; ramuli ultimi tenues, glabri apicem versus dilatati, post delapsu spicularum apice crateriformes, ramulus quisque vulgo apice spiculas tres, infra apicem spiculas binas ferens; pedicelli c. 2 mm. longi; callus pilis 5–7 mm. longis patentibus instructus; *spiculae* c.  $3\frac{1}{4}$  mm. longi; *glumae glabrae*, gluma inferior irregulariter 6-venulosa; *lemma inferius* latum, leviter trilobatum; *lemma superius* fere dimidio bilobatum, arista pallida, curvata, e basi lemmatis 7–8 mm. longa; *palea* brevis, profunde bilobata, ciliata; antherae 2 mm. longae; stigmata purpurea.

Typus: Cameron Highlands, 5,500 ft. alt., in overgrown tea estate clearing, leg. Holttum, 4.8.1946.

**Chrysopogon nemoralis** (Balansa) comb. nov.

*Andropogon nemoralis* Balansa in Morot, Journ. de Bot. 1890: 113.

*Vetiveria nemoralis* A. Camus, Fl. Gen. Indoch. 7: 329, 1922.

This species differs from most other species of *Chrysopogon* in having two sessile spikelets on the larger branches. In other respects it agrees with *Chrysopogon*, and is very different from the ample panicle of *Vetiveria*.

**Rottboellia foveolata** sp. nov.

*Culmi* fasciati, tenues, c. 50–80 cm. alti. *Laminae foliorum* ad 25 cm. longae et 6 mm. latae, basin versus sensim angustatae, supra brevissime dense pubescens; *vaginae* margine ciliatae, ad nodos breviter hirsutae; *ligula* brevis, ciliata. *Racemi* c. 6 cm. longi, c. 2 mm. lati; internodia 3 mm. longa, glabra, pedicelli spicularum paullo breviora. *Spiculae sessiles* plerumque (semper?) singulares, internodiis aequilongae, glabrae; *gluma inferior* rigida, pallida, ovata, obtusa, apice leviter retusa, carinis haud alatis, dorso omnino foveolata, foveis irregulariter quadrangularibus, in seriebus c. 6 longitudinaliter dispositis (seriebus apicem versus paucioribus), parietibus transversis spinulis minutis adscendentibus instructis; *gluma superior* tenuis, e basi ad apicem carinata, carina apicem versus anguste alata; *lemma flosculae inferioris* 2 mm. longum, latum, tenuissimum, enervatum, palea aequilonga, angustior,

2-carinata; *lemma flosculae superioris* inferiori aequilongum, *palea* brevior; *stamina* 3, *antherae* purpureae,  $1\frac{1}{2}$  mm. longae. *Spiculae pedicellati*  $1\frac{1}{2}$  mm. longae, *glumis* 2 tantum constatae; *gluma* inferior 4-venulosa, *carina* anguste alata; *gluma* superior angustior, 3-venulosa; *pedicellus* liberus (non cum internodio adnatus).

TYPUS: Setul. leg. Ridley 15231, March 1910.

This is nearly allied to *R. mollicoma* Hance, but differs in the quite glabrous inflorescences, and in the sharply defined cross-veins connecting the raised veins of the lower glume, forming series of irregular but distinct subquadrangular pits, whereas the cross-connections between the veins of *R. mollicoma* are formed only by the swollen bases of the hairs. The cross-walls of *R. foveolata* bear small spine-like outgrowths, often more than one.

## NEW SPECIES OF EUGENIA LINN. (MYRTACEAE)

By M. R. HENDERSON, F.L.S.

The following new species of *Eugenia* are described in anticipation of a critical review of the genus in the Malay Peninsula which it is hoped will be published in the near future.

*Eugenia* (§ *Syzygium*) *atronervia* sp. nov. Fig. 1.

*E. Dyeriana* King et *E. Hemsleyana* King probabiliter affinis, sed foliis multo maioribus, inflorescentiis brevioribus, floribus multo maioribus differt; necnon *E. pergamentacea* King affinis, sed floribus maioribus, nervis supra non impressis differt.

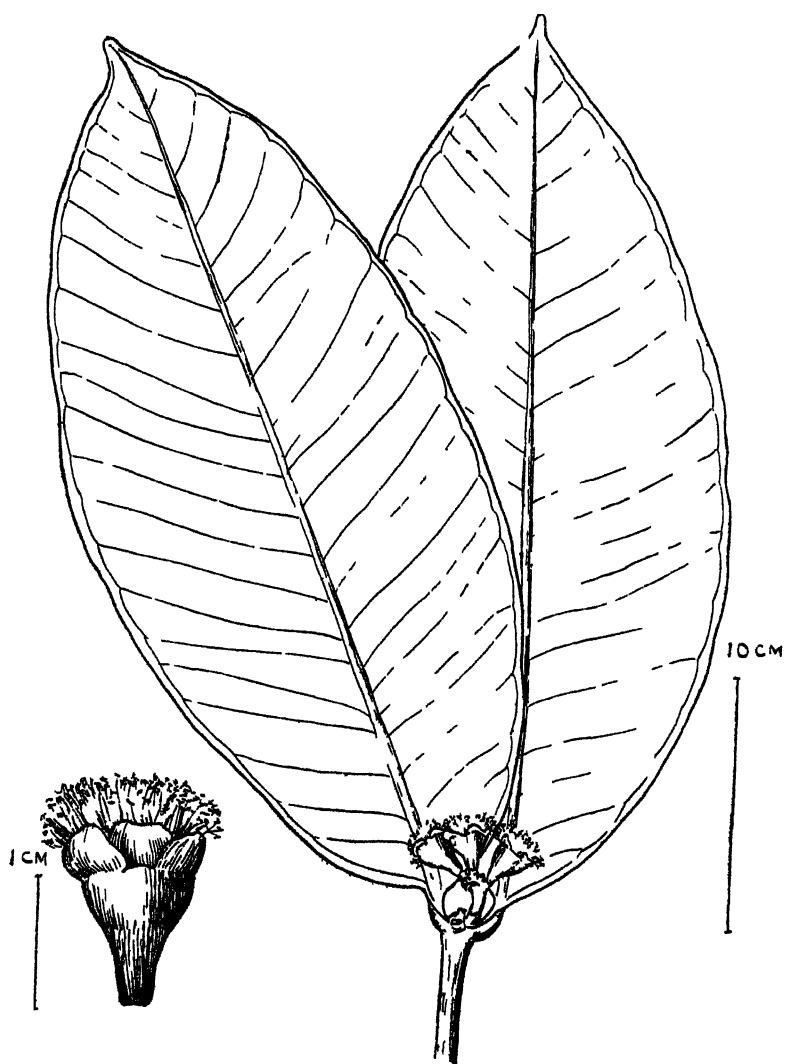
A tree 10–12 m. tall, 10 cm. diam. 2 m. from ground, with low flattened stilt roots. Bark dull rufous fawn, smooth, entire, becoming slightly creviced, not pustulate or flaky; inner bark dull madder brown or purplish brown, wood dull reddish brown.

Twigs very stout, rounded or somewhat flattened, not angled, bark black or brown, smooth or somewhat ridged, not flaky.

Leaves large, narrowly elliptic, or oblong elliptic or oblong lanceolate, up to c. 36 cm. long and 16 cm. broad, apex shortly and abruptly acuminate, base shortly narrowed and more or less decurrent on petiole; upper surface drying dull fuscous brown, lower surface a warm red brown; primary nerves c. 17–21 pairs, somewhat raised above and quite conspicuous as are the reticulations, strongly raised and black below, the lax reticulations also raised and evident, but much less conspicuous than the primary nerves; secondaries few to none; primaries nearly straight or gently curving up to a slightly looped, well marked intramarginal nerve c. 3 mm. from leaf margin; petiole very stout, widely channelled above, drying black, c. 2 cm. long.

Inflorescences terminal, from 2–5.5 cm. long, stout, the largest with a 4-angled peduncle c. 2 cm. long, with 2 pairs of stout branchlets, the lower pair 7–8 mm. long, each with 3 terminal flowers, the upper pair distant from the lower by 2.5 cm., each c. 2 mm. long with three flowers each, inflorescence axis produced 5 mm. above upper branchlets and bearing 4 flowers; other inflorescences much shorter, c. 2 cm. long, with one pair of very short stout branchlets each with 3 flowers, and three terminal flowers.

Flowers sessile, buds more or less obovoid, calyx campanulate or obconic, rather abruptly narrowed into a



*Fig. 1* *Eugenia atronervia* HENDERSON Del CHAN YORR CHYE

very short stout pseudostalk, c. 1.8 cm. long, flower c. 2 cm. across when expanded; calyx lobes 4, persistent, broad, rounded, c. 5 mm. long and 6–7 mm. broad; *petals* free, not quickly deciduous, of the same shape and size as sepals but thinner in texture; *stamens* c. 1 cm. long; *style* c. 1.5 cm. long; *ovary* 2-celled, multiovulate.

*Fruit* more or less depressed globose, up to c. 4 cm. diam., apex with a rather deep excavation c. 5 mm. diam., fringed by the very short (c. 1 mm. tall) remains of calyx tube, bearing withered stamens; surface of fruit nearly black, corrugate with broken shallow vertical ridges and furrows, smooth in places; pericarp probably pulpy or fleshy, up to c. 6 mm. thick; seed 1, transversely oblong globose, c. 2.7 cm. across, testa very thick, adhering closely to cotyledons; cotyledons side by side, nearly equal, outer surface finely rugulose, inner faces conspicuously glandular pustulate, nearly plane with a shallow wide depression, sessile, plumule and radicle rather small, attached near periphery of seed.

JOHORE: Sungai Kayu Ara, Mawai-Jemaluang road, at low elevations in dry *Dryobalanops* forest, SFN 29325 (Corner), TYPE collection, holotype in Herb. Singapore; 2nd mile, Mawai-Jemaluang road, Corner s.n.

There are two sheets of *Scortechini* 2018, Perak, sine loc., in Herb. Calcutta which may be this species, but the material is poor, one sheet consisting of incomplete leaves only, the other with flowers in young bud.

**Eugenia** (§ *Syzygium*) **Millsii** sp. nov. Fig. 2.

*Arbor* c. 14–17 m. alta, trunco c. 45 cm. diam. *Ranuli* teretes, crassi, cortice laevi pallide ochraceo vel fusco. *Folia* coriacea, anguste elliptica vel oblongo-elliptica, ad 15 cm. longa et 6 cm. lata, basi cuneata, apice breviter et obtuse acuta vel interdum plus minusve acuminata, minute punctata; *petiolis* 5–10 mm. longis; *venis primariis* utrinque 5–10, supra inconspicuis, in venas duas intra marginem confluentibus, in sicco venulis reticulatis inconspicuis vel obscuris. *Paniculae* terminales fasciculatae ad 7–8 cm. longae, pedunculis crassis, plus minusve tetragonis. *Flores* 3 in apice ramulorum, flos centralis sessilis, exteriori pedicellati. *Calycis* tubus campanulatus, c. 4 mm. longus, lobis 4 semiorbicularibus, persistentibus, c. 4 mm. longis et 5 mm. latis. *Petala* 4, subpersistencia, orbicularia, 6 mm. longa et 5 mm. lata, libera. *Stamina* ad 10 mm. longa, antheris oblongis vel late ellipticis, 0.5–0.6 mm. longis. *Ovarium* 2-loculare. *Fructus* ignotus.

A tree c. 14–17 metres tall, diam. c. 45 cm. at 2 m. from ground, trunk fluted up to c. 2 m. from ground. *Bark* smooth, brownish grey with irregular surface cracks. *Twigs* terete, stout, bark greyish white or pale brown, smooth, somewhat polished.

*Leaves* coriaceous, elliptic or oblong elliptic, up to c. 15 cm. long and 6 cm. broad, base cuneate, apex shortly and bluntly acute or sometimes more or less acuminate, drying dull brown or cinereous above, dull warm brown below, both

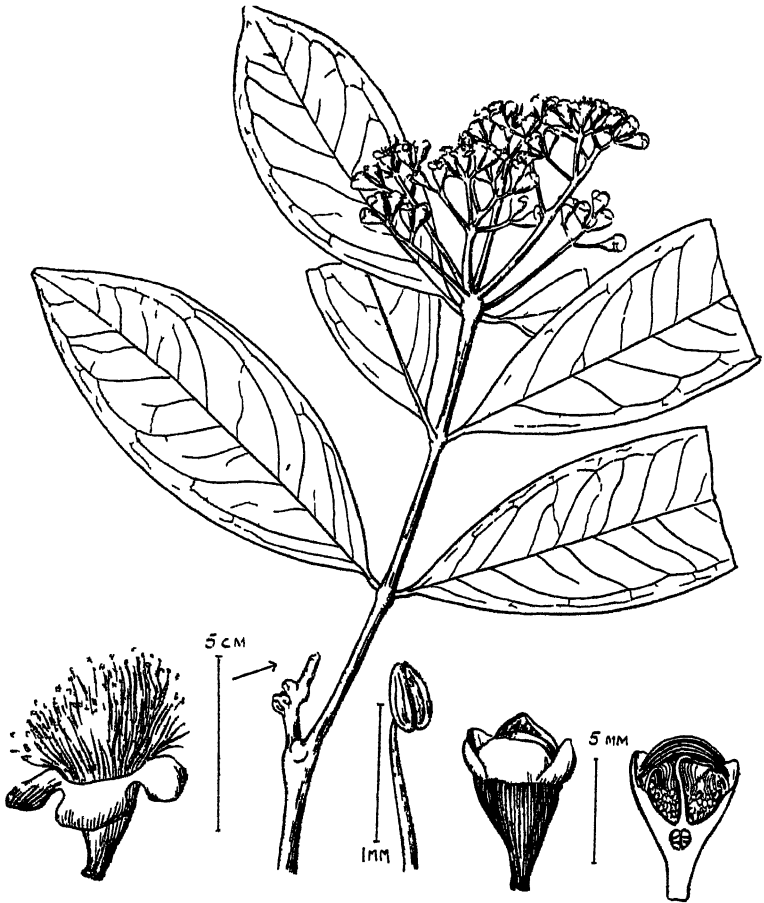


Fig. 2. *Eugenia Millsii* HENDERSON Del: CHAN YORK CHYE

surfaces minutely punctate; *petiole* pale coloured, 5–10 mm. long; midrib impressed above raised below; *primary nerves* 5–10 pairs, visible but not conspicuous above, very slightly raised and very slightly channelled, raised below and more or less conspicuous, the second or third pair from the base initiating a conspicuous intramarginal nerve 5–8 mm. from the leaf margin, the basal one or two pairs running up in a fainter intramarginal nerve c. 1–3 mm. from margin; secondaries a little finer and less conspicuous than primaries, reticulations practically invisible when dry.

*Inflorescences* terminal or from upper axils, of fascicled panicles not exceeding 7–8 cm. long, peduncles stout with pale bark, more or less 4-angled and striate. *Flowers* in

threes at ends of branchlets, the centre flower of the triads sessile, the two outers on very short stout pedicels; *calyx* tube campanulate, c. 4 mm. long, and slightly less across base of lobes, slightly contracted just below lobes, narrowed to a stout pseudostalk less than 1 mm. long; lobes 4, semiorbicular, persistent, c. 4 mm. tall and 5 mm. wide; *petals* 4, persistent for some time after the flower is fully open, orbicular, 6 mm. tall and 6.5 mm. wide, free; *stamens* numerous, longest filaments c. 10 mm. long, anthers oblong or broadly elliptic, 0.5–0.6 mm. long; *ovary* 2-celled with many ovules; *fruit* unknown.

KEDAH: Sungai Terap, near Selama, in forest on riverbank at low altitude, *SFN 35431* (Henderson), TYPE collection, holotype in Hrb. Singapore.

Outside of calyx tube and disc pale green; sepals white or very pale green; petals and stamens white. Very conspicuous in flower and visited by many insects, principally butterflies. Flowers in May.

The affinity of this species may be with *E. densiflora* var. *angustifolia*, but it differs in being a tall tree, not a bush or bushy tree, with flowers which are smaller and of a different colour. The venation also differs considerably.

Named after the late Mr. G. R. Mills, through whose hospitality I was enabled to make collections in the neighbourhood of Selama, Kedah, in May 1938.

*Eugenia* (§ *Syzygium*) *kemamanensis* sp. nov. Fig. 3.

*Arbor* 8–9 m. alta. *Ramuli* teretes. *Folia* elliptica vel elliptico-lanceolata, vel obovata, apice obtuse breviter acuminata, basi rotundata vel truncata, ad 18–19 cm. longa, 8–9 cm. lata; *nervis primariis* utrinque c. 9–11, supra impressis, inter se distantibus, vena intramarginali conjunctis; *petioli* c. 5 mm. longi. *Inflorescentiae* e nodis defoliatis ortae, c. 4 cm. longae. *Flores* in apice ramulorum 3, *pedicellis* c. 2 mm. longis. *Calyx* in alabastro obconicus, c. 4–6 mm. longus, lobis 4 rotundatis. *Petala* 4, calyptrata. *Stamina* in alabastro c. 4 mm. longa. *Stylus* in alabastro c. 4–5 mm. *Fructus* plus minusve globosus, c. 1.5 cm. diam., calycis lobis persistentibus coronatus.

A tree c. 8–9 m. tall, bark silvery grey, even, entire, inner bark pale pink, green below surface, wood pale buff. *Twigs* terete, with smooth or somewhat striate bark, pale silvery grey when dry. *Leaves* elliptic to elliptic lanceolate, sometimes more or less obovate, apex bluntly acute or shortly bluntly acuminate, narrowed to a rounded or truncate base, up to 18–19 cm. long and 8–9 cm. broad; drying pale brown on both sides, the upper surface usually rather darker than the lower, both surfaces minutely rugose when dry; midrib deeply impressed above, strongly elevate

below; *primary nerves* distant, c. 9–11 pairs, fine and sunk above, raised below, slender but conspicuous, meeting in a well marked looped intramarginal nerve c. 0.5–1 cm. from leaf margin, with a much fainter intramarginal much nearer the margin; reticulations very faint or invisible above, very fine and lax below; *petiole* pale, rather stout, c. 5 mm. long.

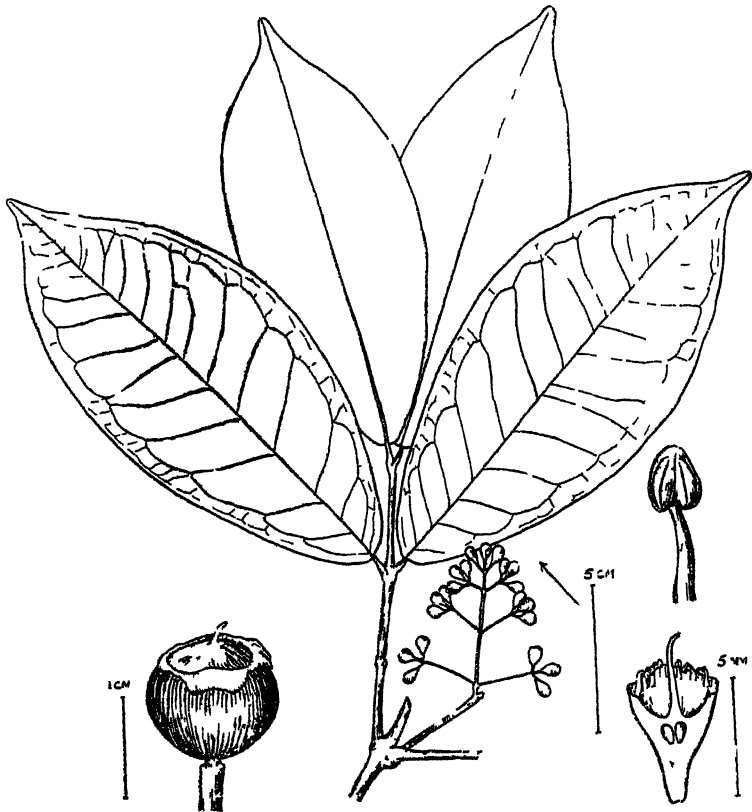


Fig. 3. *Eugenia kemamanensis* HENDERSON Del: CHAN YORK CHYE

*Inflorescences* from below leaves or on side twigs, practically sessile, c. 4 cm. long, rachis slender, 4-angled or compressed, with a few distant slender branchlets up to c. 2 cm. long, terminated by flowers in threes; pedicels not exceeding 2 mm. long. *Flower buds* (no opened flowers seen) c. 4–6 mm. long, obconic, tapering to a short pseudo-stalk; *calyx* lobes 4, broad, rounded, concave, c. 4–5 mm. broad and 3 mm. tall; *petals* 4, falling as a calyptra, but

separable, similar in shape to the calyx lobes but slightly larger and thinner in texture; *stamens* c. 4 mm. long; *style* c. 4–5 mm. long.

*Fruit* (unripe) more or less globose, crowned by the persistent sepals, c. 1.5 cm. diam., smooth or faintly vertically ridged, 1-seeded.

**KEMAMAN:** Ulu Ayam, Kajang, c. 500 ft., in forest, *SFN* 30352 (*Corner*), *TYPE* collection, holotype in Herb. Singapore. Flowers and unripe fruit in November. "Fruit pale green, flushed pink on one side (unripe); calyx and pedicels often flushed pink."

Although very little material of this species has been collected, it appears to be sufficiently distinct. The minutely wrinkled surfaces give the dried leaves a curiously leathery appearance.

*Fruit* preserved in alcohol is globose to depressed globose, up to c. 2–2.3 cm. diam., calyx rim very wide, c. 1.4 cm. diam., apex of fruit not excavate but slightly convex with more or less persistent widely separated remains of calyx lobes. Pedicels of fruit much thicker than those of flowers. Pericarp fleshy, 1.5–2 mm. thick, the brownish testa remaining on seed when pericarp is removed. Cotyledons side by side, nearly equal, surface dark, finely rugulose and wrinkled, opposing faces nearly plane, except for a narrow radial ridge on one fitting into a corresponding groove on the other, shortly broadly stalked, radicle very small, plumule evident.

**Eugenia** (§ *Syzygium*) *Ngadimaniensis* sp. nov. Fig. 4.

*Arbor* c. 20 m. alta. *Ramuli* teretes. *Folia* anguste elliptica vel elliptico-lanceolata vel oblongo-elliptica, ad c. 13 cm. longa et 5 cm. lata, apice abrupte acuminata, plus minusve caudato-acuminata, basi in petiolum longiter angustata, costa media supra impressa, subtus elevata; *venis* *primariis* utrinque c. 7–13, 5–10 mm. inter se distantibus, supra haud conspicuis, subtus teneribus, prominulis, in venam intramarginalem inconspicuam conjunctis, *venis* *secundariis* et *reticulationibus* supra obscuris, *venis* *secundariis* subtus teneribus. *Petoli* 1–1.5 cm. longi. *Inflorescentiae* terminales vel ex axillis foliorum superiorum, paniculatae, ad c. 9 cm. longae, pedunculatae. *Flores* sessiles, bracteolis oblongo-lanceolatis subacutis, subpersistentibus, alabastris obovoideis c. 6–6.5 mm. longis. *Calyx* obconicus, 3–4 mm. longus, lobis 5, c. 2 mm. latis et 0.2 mm. altis, acutis vel subacutis. *Petala* calyptratum decidua. *Stamina* ad c. 8 mm. longa, antheris parvis, c. 0.2 mm. diam., glandula inconspicua. *Ovarium* biloculare. *Bacca* ovoidea ad obovoidea, c. 2 cm. longa et 1.25 cm. lata, apice umbilico 2–3 mm. diam. calycis lobis persistentibus coronato.

A tree c. 20 metres tall. *Bark* pale brown or fawn brown, more or less smooth with fine irregular cracks, scaling in occasional irregular pieces, not papery flaky, with irregular longitudinal pits or dimples; inner bark thick, c. 1 cm., dull red or reddish brown. *Twigs* terete, youngest with smooth or slightly pustulate dark brown or reddish brown or greyish brown bark, older twigs with reddish bark longitudinally cracked and sometimes slightly flaky. *Leaves* thinly coriaceous, from c. 6 cm. long and 3.5 cm. broad or occasionally smaller to c. 13 cm.  $\times$  5 cm., narrowly elliptic

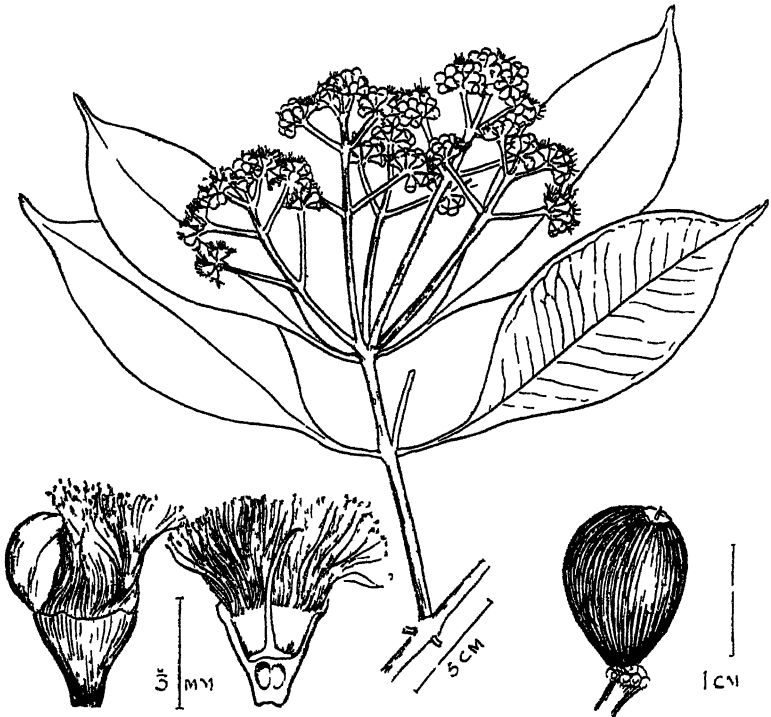


Fig. 4. *Eugenia Ngadimaniana* HENDERSON Del: CHAN YORK CHYE

or elliptic lanceolate or oblong elliptic, apex abruptly acuminate, more or less caudate acuminate, acumen 1–1.5 cm. long, base long narrowed on to petiole; upper surface when dry smooth and often shining, pale brown to dark brown, minutely and often obscurely pitted, lower surface usually paler, with minute slightly raised gland dots; midrib impressed above in a dark coloured channel, raised below; *primary nerves* c. 7–13 pairs, 5–10 mm. distant, slender but distinguishable from secondaries, sunk in narrow channels and not conspicuous above, slightly elevate below.

meeting in an inconspicuous intramarginal nerve 1-2 mm. from leaf margin; secondaries and reticulations almost invisible above, secondaries below nearly as conspicuous as primaries but distinguishable from them, reticulations below usually faint; petiole slender, 1-1.5 cm. long, reddish brown, finely wrinkled, channelled above.

*Panicles* terminal or from upper axils, solitary or more usually several from each axil or branchlet ends, up to c. 9 cm. long, peduncle 2-5 cm. long, slightly angled or compressed, bark pale, greenish brown, longitudinally wrinkled; branchlets 2-4 pairs, the lowest up to c. 2 cm. long, the upper shorter, almost horizontal or curving upwards, *flowers* crowded at branchlet ends or at end of secondary branchlets c. 3-6 mm. long, sessile, bracteoles oblong lanceolate, subacute, c. 1.5 mm. long, subpersistent; buds more or less obovoid, c. 6-6.5 mm. long. *Calyx* obconic, 3-4 mm. long, c. 3.5-4 mm. across mouth, without pseudostalk, lobes 5, shallow, broad, acute or subacute, inconspicuous, c. 2 mm. wide and 0.5 mm. tall. *Petals* falling in a calyptra but not agglutinated, more or less orbicular, c. 3 mm. diam., conspicuously gland dotted. *Stamens* numerous, filaments slender, terete, up to c. 8 mm. long, anthers very small, c. 0.2 mm. diam., connective gland inconspicuous. *Ovary* 2-celled with several ovules in each cell.

*Fruit* when dry ovoid to obovoid, c. 2 cm. long and 1.25 cm. wide, black, finely wrinkled, apical umbilicus shallow, 2-3 mm. diam., its margin with the persistent hardly enlarged calyx lobes; fresh fruit when ripe dark green slightly flushed dull purplish red at apex, obscurely ridged vertically, oblong obovoid, apical umbilicus shallow, c. 3 mm. diam., bearing the 5 small not enlarged broadly triangular acute incurved calyx lobes and style base; pericarp pithy leathery, c. 2 mm. thick; seed 1, more or less oblong, testa thick, whitish pink, brittle crustaceous; cotyledons superposed, pale yellowish white, glistening, more or less equal, inner faces plane or slightly concave, sessile.

JOHORE: Sungai Kayu, Mawai-Jemaluang road, in swampy forest, *SFN 32152* (*Kiah*).

SINGAPORE: Bukit Timah Reserve, altitude under 500 ft., *SFN 36129* (*Ngadiman*), Tree No. 392, TYPE collection, holotype in Herb. Singapore; same locality, *SFN 37012, 37020* (*Ngadiman*).

Flowers have been collected in September and October. fruits in November and December.

*Eugenia* (§ *Syzygium*) *Kiahii* sp. nov. Fig. 5.

*Arbor* c. 12 m. alta. *Ramuli* teretes, crassi, cortice laevi. *Folia* valde coriacea, ovata vel orbicularia, vel late elliptica vel elliptico-oblonga ad c. 10 cm. longa et 9 cm. lata, basi

breviter cuneata vel rotundata ad petiolum brevissime et abrupte attenuata, apice rotundata vel breve obtuseque acuta vel apiculata; petiolis c. 1 cm. longis; *nervis primariis* tenuibus, utrinque c. 7-10, in venam arcuatim e margine 2-5 mm. distantem confluentibus. *Inflorescentiae* terminales, pedunculis c. 2.5 cm. longis. *Flores* in apice ramulorum dense dispositi, alabastris obovoideis c. 7-8 mm. longis. *Calycis* tubus anguste campanulatus in stipitem plus minusve abrupte attenuatus, c. 5-6 mm. longus, lobis 5,



Fig. 5. *Eugenia Kiahii* HENDERSON Del: CHAN YORK CHYE

triangulo-ovatis, obtusis, c. 1 mm. altis. *Petala* calyptratis decidua. *Stamina* 3.5–4 mm. longa, antheris globosis vel late triangulo-ovatis, c. 0.4 mm. diam. *Ovarium* 1–2-loculare, multiovulatum. *Fructus* ignotus.

A tree c. 12 metres tall. *Twigs* stout, terete, bark smooth, sometimes polished, grey brown or pale brown or greyish white.

*Leaves* very coriaceous, ovate or orbicular, or broadly ovate oblong or broadly elliptic or elliptic oblong, up to c. 10 cm. long and 9 cm. broad, base very shortly cuneate, or rounded and very shortly and abruptly narrowed to petiole, apex rounded or shortly and bluntly acute or apiculate; both surfaces drying pale reddish brown or the upper surface blackish brown and the lower dull warm brown, petiole c. 1 cm. long; midrib impressed above, elevate below; *primary nerves* fine, raised on both surfaces, slightly less conspicuous above than below, about 7–10 pairs, meeting in an intramarginal loop 3–5 mm. from leaf margin, secondaries and reticulations raised on both surfaces, almost as distinct as primaries.

*Inflorescences* short and dense, terminal, on stout peduncles c. 2.5 cm. long; peduncles and rachis as stout as twigs, more or less compressed, secondary branchlets also stout and angled, c. 1.5 cm. long, the flowers crowded at their apices or on tertiary branchlets c. 3 mm. long. *Flower* buds obovoid, c. 7–8 mm. long, *calyx* narrowly campanulate, narrowed rather abruptly into a stout pseudostalk which is rather variable in length; length of calyx tube including pseudostalk 5–6 mm., mouth with 5 rather distant triangular ovate blunt lobes c. 1 mm. tall. *Petals* calyptrate, leathery. *Stamens* 3.5–4 mm. long, anthers globose to broadly triangular ovate, c. 0.4 mm. diam., connective gland dark brown, conspicuous, finely gland dotted. *Ovary* 1–2-locular, multiovulate. *Fruit* unknown.

JOHORE: Sungai Kayu, Mawai-Jemaluang road, SFN 32036 (*Kiah*), TYPE collection, holotype in Herb. Singapore; Sungai Kayu, in swampy forest, SFN 29400 (*Corner*).

*Eugenia* (§ *Syzygium*) *Haniffii* sp. nov. Fig. 6.

*Arbor* 15 m. alta, ramulis teretis, fuscis; *foliis* oblongis vel elliptico-oblongis, in sicco olivaceis vel fuscis, basi cuneatis, apice acuminatis, ad 13 cm. longis et 5 cm. latis; *venis primariis* utrinque 25–40, tenuibus, vena intramarginali vix distincta; petiolis c. 5–7 mm. longis. *Paniculae* terminales, densae, ad 8 cm. longae, vulgo breviores, ramis primariis crassis, ramulis ultimis tenuioribus, plus minusve tetragonis. *Flores* 3 in apice ramulorum, exteriori pedicellati, pedicellis ad 0.8 mm. longis, flos centralis sessilis.

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*Calycis* *tubus* anguste infundibuliformis, basi breve stipitatus, ad 4–6 mm. longus; lobis 4, conspicuis, persistentibus, c. 15 mm. altis et 2.5 mm. latis. *Petala* 4, membranacea, libera, subpersistencia. *Stamina* 9–12 mm. longa, stylus subaequilongus. *Ovarium* 2-loculare. *Fructus* globosi, c. 15 cm. diam., apice calycis margine et sepalis persistentibus coronati. *Semen* 1, globosum, cotyledonibus subaequalibus.

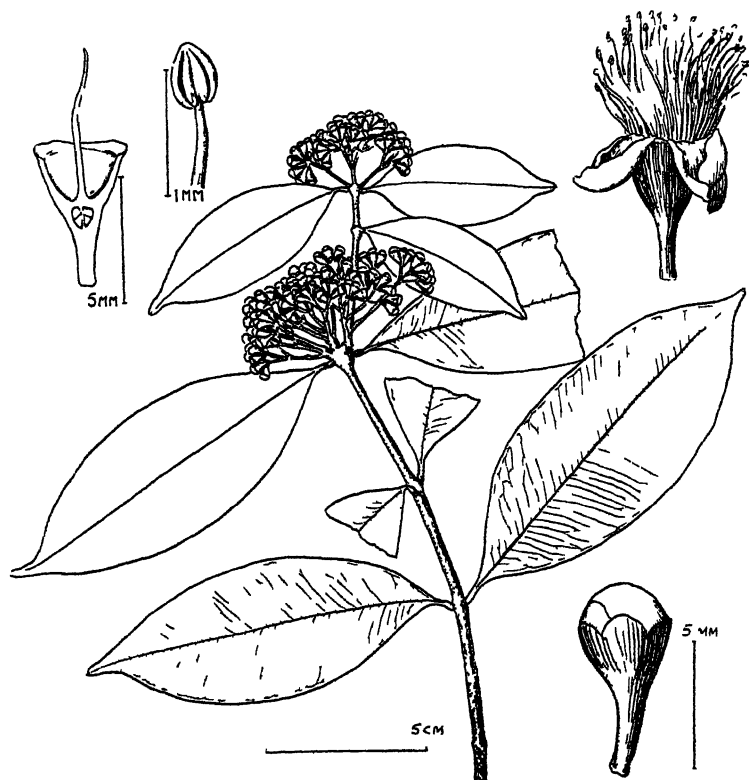


Fig. 6. *Eugenia Haniffii* HENDERSON Del: CHAN YORK CHYE

A tree 12–15 metres tall. *Twigs* rather stout, terete, their bark reddish brown, to the naked eye practically smooth, under a lens cracking longitudinally.

*Leaves* chartaceous, drying either greenish brown (recently collected specimens) or dull grey brown above and pale dull grey brown below (in older specimens), oblong to elliptic oblong, base cuneate, apex rather abruptly acuminate, up to c. 13 cm. long and 5 cm. broad; *petiole* slender, c. 5–7 mm. long, dark coloured when dry, narrowly channelled above; *midrib* sunk above, prominent below; *primary*

*nerves* fine, not more prominent than secondaries and hardly distinguishable from them, about 25–40 pairs, raised above and below, meeting in an inconspicuous intramarginal nerve c. 2–4 mm. from leaf margin, with an even more inconspicuous secondary intramarginal c. 1 mm. from margin; leaf margin slightly revolute when dry.

*Panicles* terminal, densely flowered, often much contracted, not exceeding 8 cm. long and usually much shorter, primary branches stout, with reddish brown bark as on twigs, ultimate branchlets finer, more or less 4-angled, with dark striate bark. *Flowers* in threes at ends of branchlets, the two outer on pedicels c. 0.8 mm. long, the central flower sessile. *Calyx* narrowly funnel shaped in bud, c. 4–6 mm. long including lobes, gradually narrowed to a slender pseudostalk, the centre flower of the triads with a slightly longer pseudostalk than the outers, calyx tube finely longitudinally striate and black when dry; lobes 4, conspicuous, broad, persistent after anthesis, c. 1.5 mm. high and 2.5 mm. wide, rather thick in texture with membranous edges. *Petals* 4, membranous, quite free and falling separately, persistent for some time after anthesis. *Stamens* 9–12 mm. long, *style* about as long. *Ovary* 2-locular with many ovules.

*Fruit* globose or slightly depressed globose, c. 1.5 cm. diam., (?not fully ripe), with shallow inconspicuous vertical ridges, crowned by calyx limb and persistent sepals; pericarp thin, tough; seed 1, globose, the cotyledons more or less equal, attached to hypocotyle near centre of opposing faces.

PENANG: Penara Bukit, c. 1,000 ft., *Curtis* 794, TYPE collection, holotype in Herb. Singapore. (One sheet of this collection is written up in King's hand as *E. densiflora* Duthie).

SELANGOR: 20th mile, Ginting Simpah, *Forest Dept. FMS* 12860; 23rd mile, Ginting Simpah, *Forest Dept. FMS* 13383.

Probably allied to *E. oblata* Roxb. from which it differs in the smaller flowers, more deeply lobed calyx, denser inflorescence, thinner leaves with finer and closer venation and the intramarginal nerve farther from the leaf margin. Also allied to *E. longiflora* F. Vill.

Named after the late Mohamed Haniff, who was for many years attached to the Gardens Department of the Straits Settlements.

***Eugenia* (§ *Syzygium*) *camptophylla* sp. nov. Fig. 7.**

*E. inophylla* Roxb. affinis sed lobis calycis maioribus, foliis angustioribus, venis paucioribus; necnon *E. oblata* Roxb. affinis sed floribus angustioribus et minoribus, foliis multo angustioribus, venis et venulis minus prominentibus.

A tree 12-15 metres tall, stem 20-23 cm. diam. (ex Kunstler). *Twigs* smooth, terete, bark dull brown; *leaves* lanceolate or narrowly elliptic lanceolate, or somewhat ovato-lanceolate, up to c. 13 cm. long and 4 cm. broad, apex long acuminate, often folded or bent sideways when dry, base long narrowed and somewhat decurrent on petiole; upper surface drying blackish brown, lower surface dull reddish brown; midrib sunk above in a narrow channel, raised below; *primary nerves* about 20 pairs, very faint above, slightly raised and channelled, very slender and inconspicuous below, slightly raised, meeting in a very fine intramarginal nerve 1-2 mm. from the recurved leaf margin; secondaries and reticulations almost invisible above, a little less conspicuous than primaries below; *petiole* up to c. 1 cm. long, slender, black, wrinkled, deeply channelled above.

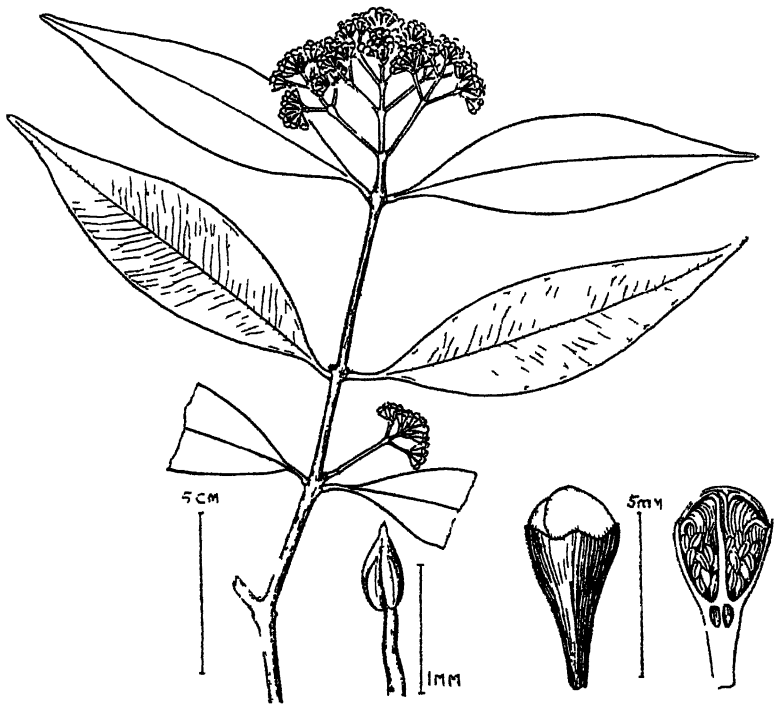


Fig. 7. *Eugenia camptophylla* HENDERSON Del: CHAN YORK CHYE

*Inflorescence* a spreading panicle, or several together, terminal or from upper one or two axils, on a peduncle up to c. 4 cm. long, but usually much shorter and not exceeding c. 1 cm., peduncle and inflorescence branches rather slender,

strongly angled, with striate bark, inflorescence up to c. 9.5 cm. long and 6 cm. across. *Flowers* densely crowded at ends of branchlets, c. 1 cm. long, sessile, bracteoles small and inconspicuous, soon falling; *calyx* in bud funnel shaped, c. 6 mm. long and 3 mm. across mouth, tapering gradually from apex to base, the pseudostalk c. 2–3 mm. long, but not sharply marked off, calyx mouth with 5 broad shallow inconspicuous blunt or subacute lobes c. 1.25 mm. wide and 0.5 mm. high, but variable in size, persisting for some time after the flower has opened and the stamens fallen; *petals* probably falling as a calyptra but easily separable, more or less orbicular, c. 3 mm. diam; *stamens* numerous, filaments slender, up to c. 8 mm. long, anthers triangular ovate, c. 0.5 mm. long, connective produced beyond anthers into a narrow triangular gland; *style* considerably stouter than filaments, c. 6 mm. long. *Fruit* unknown.

PERAK: Gopeng, 500–800 ft., open jungle in hilly locality, *Kunstler 5994*. TYPE collection, holotype in Herb. Calcutta.

Known only from the type collection of which I have seen three sheets in Herb. Calcutta and two in Herb. Dehra Dun.

The extension of the connective in the stamens beyond the anthers into a narrow triangular gland seems to be rare in *Eugenia* and has been seen otherwise only in an unidentified species of unknown origin cultivated in the Botanic Gardens, Singapore.

*Eugenia* (§ *Syzygium*) *Brantiana* sp. nov. Fig. 8.

*Frutex* vel *arbor* parva; ramulis teretibus, cortice laevi; *foliis* oblongo-ellipticis ad ovatis, ad c. 13 cm. longis et 5 cm. latis, apice longe acuminatis, acumine ad 1–2 cm. longo, basi cuneatis ad petiolum attenuatis, petiolo c. 0.5 cm. longo; costa supra canaliculata, subtus elevata, *venis* *primariis* utrinque ad c. 15, supra laud conspicuis, subtus leviter elevatis submanifestis, in venam intramarginalem inconspicuam 1–2 mm. a margine distantem confluentibus; *inflorescentiis* terminalibus vel ex axillis foliorum superiorum, paniculatis, subsessilibus vel pedunculatis, ad c. 9 cm. longis, ramis *primariis* ad c. 2 cm. longis, floribus sessilibus, confertis; *alabastris* c. 1 cm. longis; *calycis* tubo c. 7–8 mm. longo, apice c. 5 mm. lato, basi stipitato (stipite c. 2–3 mm. longo), lobis inconspicuis, c. 0.75 mm. altis et 2–2.5 mm. latis, glandulosis; *staminibus* numerosissimis, 15–16 mm. longis, antheris oblongo-ovatis, 0.5–0.75 mm. longis, connectivo conspicue glanduloso-mucronato; *fructibus* ignotis.

A shrub or small bushy tree. *Branchlets* terete, bark smooth, grey brown to reddish. *Leaves* thinly coriaceous, oblong elliptic to ovate, up to c. 13 cm. long and 5 cm. broad,

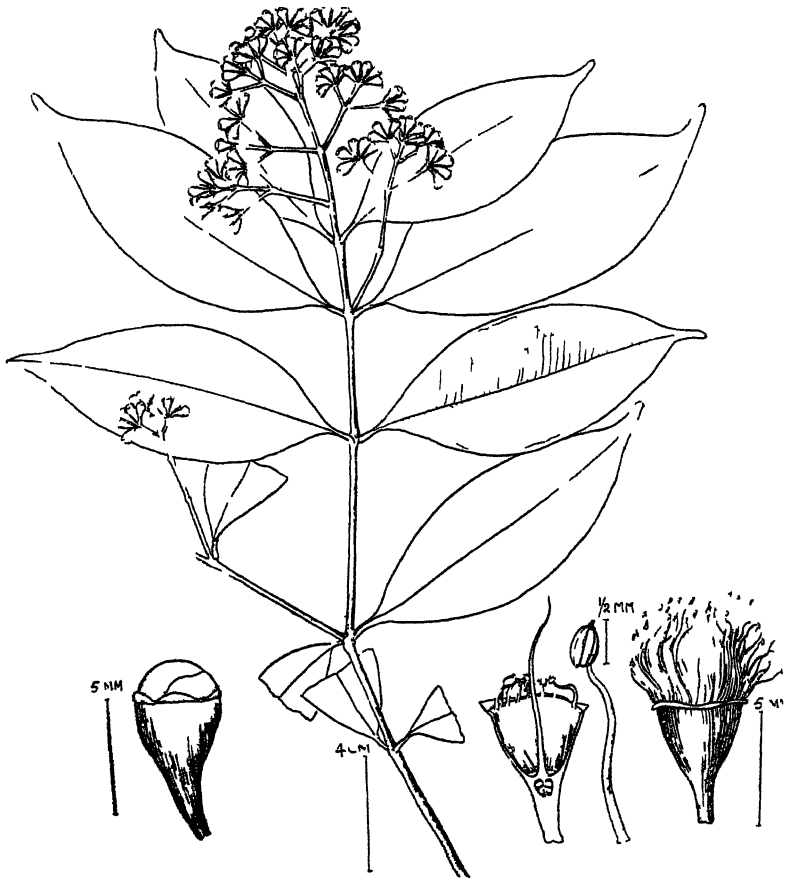


Fig. 8. *Eugenia Brantiana* HENDERSON Del. CHAN YORK CHYE

apex long acuminate, acumen 1-2 cm. long, base cuneate and narrowed on to petiole, upper surface drying greenish to reddish brown, minutely gland dotted, lower surface greenish to brownish, paler than upper, minutely gland dotted; midrib shallowly impressed above, elevate below; *primary nerves* up to about 15 pairs, slender and not conspicuous above, pale and very slightly raised, slightly raised and slender below, a little more conspicuous than secondaries; secondaries and reticulations usually obscure above, visible below and almost as conspicuous as primaries; intramarginal nerve slender and inconspicuous, 1-2 mm. from margin; *petiole* c. 0.5 cm. long, drying dark red brown.

*Inflorescence* terminal or from upper axils, paniculate, up to c. 9 cm. long, nearly sessile or peduncles up to c. 3 cm.

long, primary branchlets up to c. 2 cm. long, flowers clustered either at ends of primary branchlets or of secondary branchlets c. 0.5–1 cm. long; bark of inflorescence reddish brown to greenish brown, peduncle more or less terete, branchlets compressed or more or less 4-angled; bracteoles very small and fugacious. *Flowers* sessile, buds c. 1 cm. long, *calyx* c. 7–8 mm. long, c. 5 mm. across mouth, very finely wrinkled, narrowed at base into a rather stout pseudostalk 2–3 mm. long, lobes broad, shallow, inconspicuous, c. 0.75 mm. high and 2–2.5 mm. wide, pellucidly gland dotted; *petals* with pellucid gland dots, falling in a calyptra; *stamens* very numerous, 15–16 mm. long, anthers ovate oblong, 0.5–0.75 mm. long, connective gland brown, conspicuous; *style* 12–13 mm. long; *ovary* 2-celled with several ovules in each cell; *fruit* unknown.

JOHORE: Sungai Pontian Besar, common on the river bank in the *Terminalia-Pandanus* zone, SFN 36754 (*Henderson*), TYPE collection, holotype in Herb. Singapore; same locality, SFN 36956 (*Corner & Henderson*).

Named after the late Mr. R. V. Brant, sometime Assistant Adviser, Pontian.

Allied to *E. inophylla* Roxb., but differing in the paler bark of the twigs, the paler leaves when dry, the much longer stamens, and in being a bush or small bushy tree of tidal rivers.

***Eugenia* (§ *Syzygium*) *pseudosyzygioides* sp. nov. Fig. 9.**

*E. cymosa* Wight valde affinis, sed cortice trunci pallide laevi, cortice ramulorum pallidiore, stipite calycis longiore, tubo calycis infundibuliformis, in sicco pustulato et rugoso, petalis vulgo calyptratis differt.

*Arbor* 18–24 m. alta, c. 25–60 cm. diam. *Ramuli* teretes, graciles, laeves. *Folia* ovata, ovato-lanceolata ad oblongo-lanceolata, vel anguste elliptica, apice caudato-acuminata, basi cuneata, 4 cm. × 2 cm. ad 9.5 cm. × 4.5 cm., *petiolis* gracilibus, 3–5 mm. longis; *nervis primariis* numerosis. *Paniculae* terminales et axillares ad 7 cm. longae, vulgo 4–5 cm. longae. *Flores* sessiles, in apice ramulorum brevissimorum ternati vel pseudoumbellati; alabastris c. 5–6 mm. longis; *calycis* tubo infundibuliforme, breviter stipitato, lobis 5, c. 0.5 mm. latis et 0.3 mm. longis. *Petala* vulgo calyptrata, ?vel interdum libera. *Stamina* ad 5–6 mm. longa, antheris oblongis, c. 0.4 mm. longis. *Stylus* c. 5–6 mm. longus. *Ovarium* 2-loculare. *Fructus* ignotus.

A tree 18–24 metres tall, c. 25–60 cm. diam. 2 metres from ground, trunk cylindric. *Bark* dull greyish, pallid, smooth, entire, faintly marked with transverse ridges but even in other places; inner bark thin, greyish brown; wood



Fig. 9. *Eugenia pseudosyzygioides* HENDERSON Del: CHAN  
YORK CHYE.

pallid buff, darkening and turning brownish drab on exposure. *Twigs* slender, terete, their bark smooth or finely longitudinally cracked, the youngest twigs brown or reddish brown, the older ones whitey-brown to pale grey.

*Leaves* thinly coriaceous, ovate, ovate lanceolate to oblong lanceolate, or narrowly elliptic, apex caudate acuminate, the acumen up to 2 cm. long, base cuneate, variable in size from c. 4 cm. long and 2 cm. broad to 9.5 cm. long and 4.5 cm. broad; upper surface drying dull brown to lead colour, lower surface usually paler, brown to reddish brown; *petiole* slender, deeply and narrowly channelled above, wrinkled and pustulate below, dark red brown, 3–5 mm. long; midrib narrowly channelled above, raised below, more or less pustulate, especially towards petiole; *primary nerves* numerous, close and parallel, not distinguishable from secondaries, reticulations almost as conspicuous, all raised on upper surface and more strongly raised on lower surface, sometimes much darker than surrounding leaf surface; intramarginal vein very close to and partly hidden by the revolute margin; upper surface minutely punctate, lower surface sparsely black dotted.

*Panicles* axillary and terminal, up to c. 7 cm. long but usually 4–5 cm. long, peduncles and branches slender, spreading, compressed or angled, with dark, longitudinally wrinkled, often pustulate bark. *Flowers* sessile in threes at ends of very short branchlets, or these branchlets so reduced that the flowers appear umbellately arranged; flower buds c. 5–6 mm. long; *calyx tube* funnel shaped, usually more or less pustulate, narrowing to a slender pseudostalk, mouth with 5 shallow rounded broad lobes c. 0.5 mm. wide and 0.3 mm. high. *Petals* calyptrate, apparently occasionally free, orbicular. *Stamens* up to c. 5–6 mm. long, anthers oblong, c. 0.4 mm. long with conspicuous brown gland on connective. *Style* rather stout, 5–6 mm. long. *Ovary* 2-celled. *Fruit* unknown.

KEMAMAN: Bukit Kajang, 500 ft., SFN 30451 (*Corner*), TYPE collection, holotype in Herb. Singapore, SFN 30421 (*Corner*), SFN 30497 (*Corner*). Flowers in November.

PERAK: Larut, within 100 ft., in open old jungle in low ground, *Kunstler* 3422, "leaves light green, very glossy", flowers in October.

This species is evidently closely allied to *E. cymosa* from which sterile specimens cannot be distinguished with certainty in the Herbarium, except for the usually narrower, more oblong leaves. In the field, however, the trees are quite distinct, *E. pseudosyzygioides* having a smooth pale bark, while *E. cymosa* has a dark red or fuscous brown bark which is more or less fissured and flaky.

Most of the specimens of *E. pseudosyzygioides* on which flowers at the proper stage are to be found, have calyptrate petals, whereas in most of the specimens of *E. cymosa* in Herb. Singapore the petals are free. Koorders & Valetton and King describe them as free, Gagnepain as calyptrate. It is not a very reliable character, for both free and calyptrate petals may be found on the same individual.

**Eugenia (§ Syzygium) praestigiosa** sp. nov. Fig. 10.

?Arbor. *Ramuli* teretes, laeves. *Folia* coriacea, oblongo-lanceolata vel oblongo-elliptica, ad c. 9 cm. longa et 3.75 cm. lata, apice acuminata, basi attenuata, supra punctata, subtus pustulato-punctata, punctis nigris densis; *nervis primariis* tenuibus utrinque 12-15, in venam submarginalem a margine c. 1 mm. distantem conjunctis, petiolis ad 1 cm. longis. *Inflorescentiae* fasciculatae, terminales vel axillares, spiciformes vel paniculatae pauci-ramosae, ad 4.5 cm. longae. *Flores* sessiles ad apice ramulorum conferti. *Calycis* tubus in alabastro c. 6-6.5 mm. longus et 3.5-4 mm. latus, anguste infundibuliformis, lobis 4 rotundatis persistentibus c. 2 mm.



Fig. 10. *Eugenia praestigiosa* HENDERSON Del: CHAN YORK CHYE

altis et 3 mm. latis. *Petalu* 4, libera, reflexa, rotunda, c. 5 mm. diam., glandulosa. *Stamina* ad 9-10 mm. longa, antheris oblongis, 0.7-0.8 mm. longis. *Stylus* c. 8 mm. longus. *Ovarium* 2-loculare. *Fructus* ignotus.

?A tree, *twigs* terete, their bark smooth, not polished, dark brown or dark reddish brown, in places pale grey and finely cracked. *Leaves* coriaceous, oblong-lanceolate or oblong-elliptic, up to c. 9 cm. long and 3.75 cm. broad, apex acuminate, base narrowed, upper surface drying olivaceous brown or reddish brown, slightly shining, minutely and densely punctate, lower surface paler and duller, minutely and densely black pustulate-dotted; midrib sunk above, raised below and pustulate except at apex, and longitudinally wrinkled; *primary nerves* about 12-15 pairs, very fine and slender above, slightly raised, fine below but rather more conspicuous than on upper surface, raised, meeting in a fine intramarginal nerve c. 1 mm. from recurved leaf edge; secondary veins only partially visible above, reticulations very obscure or invisible, secondaries and reticulations fine and raised below but distinctly less conspicuous than primaries; petiole c. 1 cm. long, rather slender, deeply channelled above, drying black.

*Inflorescences* crowded, terminal or in upper axils, spiciform or paniculate with few branches, up to c. 4.5 cm. long, rachis compressed or angled with strongly striate pale brown bark. *Flowers* sessile, crowded at or near ends of inflorescence branches. *Calyx* in bud c. 6-6.5 mm. long and c. 3.5-4 mm. across mouth, obconic or campanulate and tapering gradually to base, somewhat striate, pseudostalk very short, not evident, rather abruptly expanded at the mouth into 4 deep rounded persistent lobes c. 2 mm. high and 3 mm. across. *Petals* 4, free, reflexed after flower opens, more or less orbicular, c. 5 mm. across, gland dotted. *Stamens* numerous, filaments slender, up to c. 9-10 mm. long, anthers oblong, c. 0.7-0.8 mm. long, connective gland obscure or absent. *Style* rather stout, tapering to apex, c. 8 mm. long. *Ovary* 2-celled with several or many ovules in each cell. *Fruit* unknown.

PERAK: sine loc., *Scoricchini sine num.*, TYPE collection, holotype in Herb. Calcutta.

Unfortunately no indication of locality and no date or number is given on any of the five sheets of this collection in Herb. Calcutta.

This plant appears quite distinct from any other *Eugenia* described from the Malay Peninsula. The inflorescences recall those of *E. rugosa* Merr., but the flowers and foliage are quite different. The flowers resemble those of *E. longiflora* F. Vill., but are shorter, with more conspicuous petals, and the inflorescence and leaves differ considerably.

The plant is distinctive amongst the Peninsular species in its short crowded inflorescences, and the crowded flowers with conspicuous calyx lobes and petals.

Included in the same cover in Herb. Calcutta was a sheet of *Forbes 2985* from Sumatra. This is in fruit only and at first sight appears very close to *E. praestigiosa*, but it differs in having pale yellow and somewhat polished twigs, thinner leaves not punctate above, with shorter petioles. The inflorescences are very like those of *E. praestigiosa*. The fruit of Forbes' plant is smooth and oblong without persistent calyx lobes and is of the type associated with the clavate or peg-shaped flowers of such species as *E. attenuata* K. & V. The fruit of *E. praestigiosa* is more likely to resemble that of *E. longiflora*, probably with persistent calyx lobes.

*Eugenia* (§ *Syzygium*) *quadribracteata* sp. nov. Fig. 11.

*Arbor* c. 20 m. alta, glabra. *Folia* vulgo elliptico-oblonga, ad 25 cm. longa et 10 cm. lata, apice breviter obtuse acuminata vel acuta, basi breviter acuminata et in petiolum breviter decurrentia, utrinque dense punctata; *venis primariis* tenuibus, numerosis, utrinque c. 60, vena intramarginali tenui distincta conjunctis; *petiolis* crassis c. 1-1.3 cm. longis. *Inflorescentiae* terminales vel interdum axillares, ad 9 cm. longae. *Flores* sessiles in apice ramulorum dense capitulati, bracteolis 4 persistentibus instructi. *Calyx* in alabastro plus minusve globosus, post anthesis obconicus, c. 3-4 mm. longus et 4-5 mm. latus, lobis 5, late triangularis, rotundatis. *Petala* calyprata. *Stamina* c. 5-6 mm. longa, stylus aequilongus. *Fructus* immaturus plus minusve globosus, 5-6 mm. diam., calycis margine coronatus.

A tree c. 20 metres tall. Twigs stout, terete, bark smooth or creviced or slightly flaky, brown or greyish brown, the youngest twigs with quite smooth dark warm brown bark. Leaves generally oblong elliptic, occasionally tending to be ovate, up to c. 25 cm. long and 10 cm. broad, but generally rather smaller, apex shortly bluntly acuminate or acute, base shortly narrowed and slightly decurrent on petiole; petiole stout, drying black, c. 1-1.3 cm. long; primary nerves very numerous and close together, hardly distinguishable from secondaries, up to about 60 pairs, fine but distinctly elevate above and below, secondary nerves and reticulations little less conspicuous than primaries; intramarginal nerve as distinct as primaries, c. 2-3 mm. from the revolute leaf margin; upper surface drying dull greyish brown, densely and minutely punctate, lower surface rather warmer brown or reddish brown, also densely and minutely punctate.

*Inflorescences* terminal or occasionally axillary, sometimes fasciculate, axis and branches as stout as or stouter than twigs, rounded or compressed or angled, with almost black, finely striate bark, up to 9 cm. long, branches distant and short, usually horizontal or somewhat decurved. *Flowers* sessile, densely crowded in heads at the branch ends, each flower subtended by 4 broad, triangular, more or less persistent blunt bracteoles. *Calyx* more or less globose in bud, obconic after anthesis, c. 3-1 mm. long and 4-5 mm. across mouth, lobes 5, broadly and shallowly triangular, rounded or somewhat acute. *Petals* calyptrate. *Stamens* c. 5-6 mm. long, *style* about same length. *Immature fruit* globular or somewhat depressed globular, 5-6 mm. diam., crowned by calyx rim.



Fig. 11. *Eugenia quadribacteata* HENDERSON Del: CHAN YORK CHYE

PENANG: Waterfall, *Curtis s.n.*, undated, TYPE collection, holotype in Herb. Singapore.

JOHORE: Kota Tinggi-Mawai road, *SFN 30986* (Corner), frequent in drier parts of swampy forest.

Although Curtis' specimens are fairly complete, they appear not to have been taken up either by King in the "Materials" or by Ridley in his Flora.

The species is a distinct one in the large closely veined leaves and the stout inflorescence with the unusual arrangement of bracteolate flowers. It may be allied to *E. argutata* Koord. & Valet., of which I have seen no material.

*Wray 3771*, from Upper Perak, alt. 1,000 ft., two fruiting sheets of which are in Herb. Calcutta, may possibly belong here.

**Eugenia** (§ *Syzygium*) *cerina* sp. nov. Fig. 12.

*E. punctulata* King, Mat. F.M.P., No. 12, 122 (1901); Ridl., F.M.P., I. 747; Corner, Wayside Trees of Malaya, p. 502; non F. M. Bailey (1896). *Syzygium incarnatum* Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 195 (1939), non *Eugenia incarnata* Eln.

*Arbor* ad c. 27 m. alta. *Ramuli* teretes vel juniores compressi, cortice desquamante. *Folia* coriacea, obovata, oblanceolata vel interdum oblonga, apice rotundata, retusa, vel breviter et abrupte acuminata, basi sensim vel abrupte attenuata, 2.5–11 cm. longa, 1.5–5 cm. lata, margine recurva, costa media subtilis prominente, supra impressa, nervis primariis utrinque c. 16 vel pluribus, indistinctis, vena intramarginali tenui conjunctis. *Petiolus* 0.5–1 cm. longus. *Paniculae* terminales vel interdum axillares, laxae ramosae, ad c. 12 cm. longae, ramis et ramulis compressis, striatis. *Flores* sessiles in apice ramulorum conferti. *Calyx* campanulatus vel obconicus, brevistipitatus, c. 2.25–2.5 mm. longus et 2 mm. latus, breviter et obscure 4-dentatus. *Petala* calyptrata. *Stamina* c. 15–30, filamentis complanatis, 0.5–0.75 mm. longis. *Stylus* c. 0.5 mm. longus. *Ovarium* biloculare. *Fructus* oblongo-obovoideus, 1.2–1.4 cm. longus, 7–8 mm. latus, apice complanatus et umbilicatus, umbilico calycis margine brevissimo cincto.

A tree up to c. 27 metres tall, fluted at base, or buttressed, the buttresses sometimes up to c. 1.5 metres, or cylindric, or with a few stilt roots. Bark of trunk reddish or reddish orange, rugose in older trees, more or less papery flaky, a thin green layer next to outer layers, then a buff or yellowish fibrous brittle inner layer, wood hard, pale buff.

*Twigs* terete or the youngest somewhat compressed, bark pale brown to reddish brown or pale greyish brown, thinly papery flaky. *Leaves* coriaceous, obovate, oblanceolate or occasionally oblong, apex rounded, retuse, or with a

short broad point, or abruptly acuminate with acute or blunt acumen, narrowed at base gradually or abruptly, 2.5–11 cm. long, 1.5–5 cm. broad; margins usually recurved when dry, upper surface olivaceous, pale brown or reddish brown to dark brown, usually dull, lower surface usually lighter; midrib depressed above, elevate and keeled below; *primary nerves* usually about 16 pairs but often more, not curving, usually slightly raised above but not conspicuous, more or less raised below, faint and with difficulty distinguishable from secondaries, meeting in a slender intramarginal nerve which is close to the leaf margin and often hidden by the recurved margin; secondaries and reticulations obscure or faint above, sometimes invisible below or sometimes almost as conspicuous as primaries. *Petiole* 0.5–1 cm. long, channelled above, keeled below,

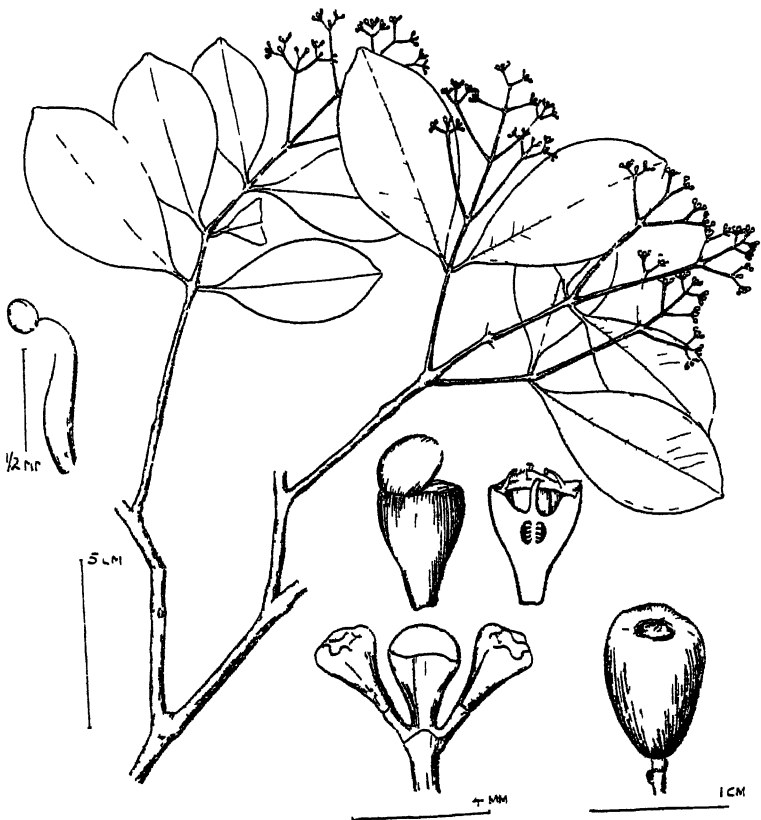


Fig. 12. *Eugenia cerina* HENDERSON Del: CHAN YORK CHYE

*Panicum* terminal or occasionally from the upper axils, lax, up to c. 12 cm. long, branches spreading, compressed, finely striate with pale brown or brownish grey bark. *Flowers* small, sessile, crowded at ends of the short ultimate branchlets, bracts and bracteoles very small and inconspicuous; buds obovoid, c. 2.75–3.25 mm. long; *calyx* campanulate or obconic, c. 2.25–2.5 mm. long and 2 mm. across mouth, narrowed to a very short stout pseudostalk c. 0.5 mm. long, mouth very obscurely and shallowly 1-toothed; *petals* calyptrate; *stamens* c. 15–30, filaments 0.5–0.75 mm. long, broad and flattened, tapering slightly from base to apex, anthers small, oblong, connective gland small and inconspicuous; *style* c. 0.5 mm. long, narrowly conical; *ovary* 2-celled.

*Fruit* oblong-obovoid, apex flattened, 1.2–1.4 cm. long and 7–8 mm. wide at widest point, apex deeply and narrowly excavate, with very short calyx rim; pericarp fleshy, 3–4 mm. thick, seed more or less globose, c. 4 mm. diam., testa adhering to it but peeling off easily leaving a thicker inner layer beneath which is a mucilaginous coat; cotyledons more or less equal, opposing faces folded, with the large hypocotyle, which is grooved along one side, lying in the fold and extending to periphery of seed.

PERAK: Blanda Mabok, *Wray 3972*, TYPE collection, holotype in Herb. Singapore. Common in lowland forest from Perak to Singapore.

*Distrib*: Sumatra, Borneo.

A full explanation of the nomenclatorial problems connected with this species, and the reasons for redescribing it instead of merely giving it a new name will be given in the forthcoming critical account of *Eugenia* referred to in the prefatory note to this paper.

*Eugenia* (§ *Syzygium*) *nemestrina* sp. nov. Fig. 13.

*Arbor* 25–30 m. alta. *Ramuli* crassi, teretes, vel ad nodos plus minusve compressi, cortice laevi vel desquamante. *Folia* coriacea, anguste elliptica ad oblongo-elliptica, 6–11 cm. longa, 2–4.5 cm. lata, apice acuminata deflexa, basi cuneata in petiolum longiter attenuata; pagina inferiore minute nigro-punctata; *nervis primariis* utrinque c. 20–25, tenerrimis, supra inconspicuis vel obscuris, subtus inconspicuis, in venam intramarginalem e margine c. 1 mm. distantem conjunctis; *petiolis* 5–8 mm. longis, rugosis. *Inflorescentiae* corymbosae ad 8 cm. longae et latae, multiramosae. *Flores* vulgo 3 vel interdum 1 in apice ramulorum, sessiles vel pedicellati, pedicellis 2–4 mm. longis, alabastris c. 1.3–1.4 cm. longis. *Calycis* tubus cyathiformis, in stipitem 4–5 mm. longum attenuatus, apice c. 6 mm. latus, post anthesin infundibuliformis, apice c. 7 mm. latus, margine truncatus vel interdum cum dentibus minutissimis. *Petala*

calyptratim decidua. *Stamina* 1-25 cm. longa, antheris c. 0.5 mm. longis et 0.4 mm. latis, paulum brevioribus. *Ovarium* 2-loculare, multiovulatum. *Fructus* plus minusve globosus, c. 1.5 cm. diam, calycis margine undulato c. 2 mm. alto coronatus.

A tree 25-30 metres tall, slightly or prominently buttressed-fluted at base to 2 metres from ground. *Bark* rufous brown, fissured or distinctly scaly flaky, inner bark deep purple. *Twigs* stout, terete or more or less compressed at nodes, the youngest with smooth or striate or finely rugose pale brown bark, the older twigs with a pale layer scaling off and leaving scaly flaky red brown bark below.

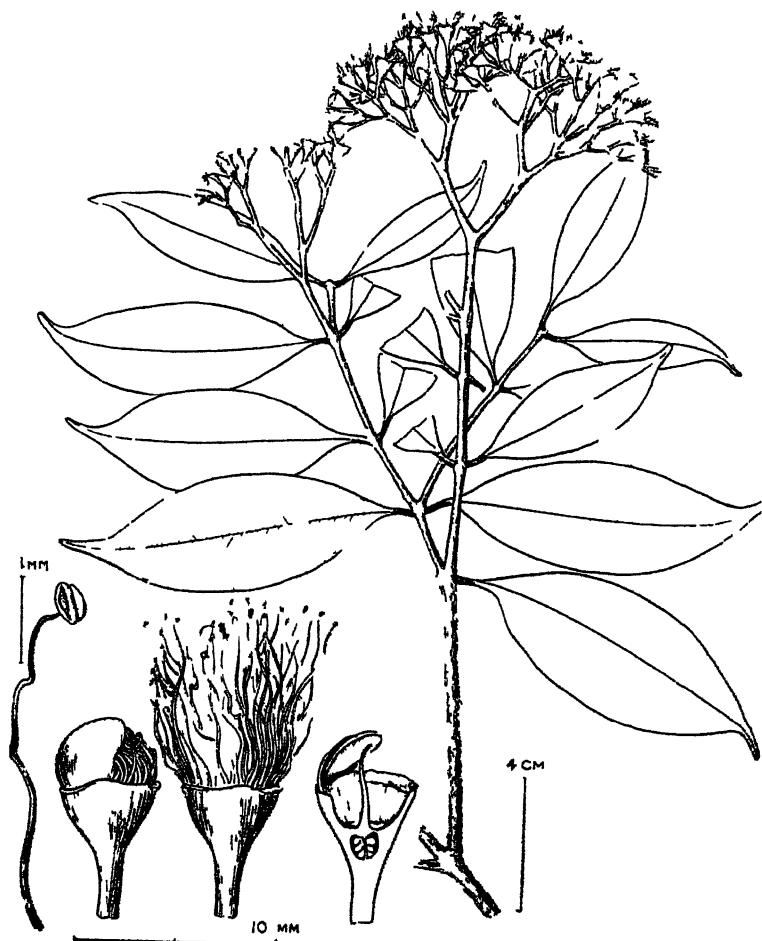


Fig. 13. *Eugenia nemestrina* HENDERSON Del: CHAN YORK CHYE

*Leaves* decussate, narrowly elliptic to oblong elliptic, 6–11 cm. long, 2–4.5 cm. broad, coriaceous, in life dull green withering yellow, margins upcurled and apex reflexed, when dry upper surface pale brown or reddish brown, lower surface dull pale brown to whitish brown but not glaucous, apex acuminate and deflected sideways, base cuneate and long narrowed on to petiole; midrib sunk in a narrow channel above, strongly raised and keeled below; *primary nerves* very fine, c. 20–25 pairs, raised above and visible because of their pale colour, or in pale leaves almost invisible, hardly distinguishable from secondaries, fine and raised below, very little more conspicuous than secondaries and sometimes only distinguishable from them by their junction with the intramarginal vein, reticulations slightly thickened and raised; upper surface not punctate, lower minutely black dotted; intramarginal nerve fine, c. 1 mm. from the slightly revolute leaf margin; *petiole* 5–8 mm. long, of the same colour as the leaf and wrinkled.

*Inflorescences* corymbose, terminal, not exceeding c. 8 cm. long and wide, much branched, the primary branchlets about half as thick as twigs, of the same colour, bark longitudinally wrinkled and somewhat pustulate, the ultimate branchlets compressed and ridged. *Flowers* usually in threes or sometimes solitary at ends of branchlets, sessile or sometimes on pedicels 2–4 mm. long, or the outer two flowers of the triads shortly pedicelled and the central one sessile; buds c. 1.3–1.4 cm. long, including pseudostalk, calyx tube cyathiform, c. 6 mm. across mouth, tapering into a ridged pseudostalk c. 4–5 mm. long; mouth truncate or wavy or occasionally with exceedingly obscure teeth; after anthesis the calyx funnel shaped, c. 7 mm. across mouth. *Petals* calyptrate. *Stamens* numerous, 1–2.5 cm. long, filaments tapering very gradually from base to apex, anthers c. 0.5 mm. long and 0.4 mm. broad, apical gland distinct, dark coloured. *Style* a little shorter than stamens. *Ovary* 2-celled with many ovules in each cell.

*Fruit* smooth, more or less globular, c. 1.5 cm. diam., crowned by the very conspicuous undulating calyx rim c. 2 mm. high; pericarp 2–3 mm. thick, stripping easily from seed which is left without testa (alcohol material); cotyledons nearly equal, outer surfaces closely rugose, inner faces more or less plane, attached to the hypocotyle by short broad stalks either about the centre or near the periphery.

SINGAPORE: McRitchie Reservoir, SFN 33590 (*Corner*), TYPE collection, holotype in Herb. Singapore; Selitar, near Nee Soon village, SFN 37396 (*Corner*), Mandai road, SFN 37252 (*Corner*).

Calyx pale green, gland dotted, petals white, stamen filaments white with green bases. Flowers smelling as those

of *E. grandis*. Flowers in July, December, January, fruits full grown and falling ripe in October.

It may seem surprising that there are still novelties to be found in the last remaining patches of forest in the island of Singapore, but that such is the case serves to emphasise the difficulties of collecting in tropical forests and to point to the exceeding usefulness of the trained *brok* monkeys (*Macacus nemestrina*) used as collectors by the Singapore Botanic Gardens. Ample material of this species was collected by one of them.

***Eugenia* (§ *Syzygium*) *taipingensis* sp. nov. Fig. 14.**

*Arbor* 4.5–6 m. alta, trunco 8–13 cm. diam. *Ramuli* teretes, cortice pallide cano vel ultimi cortice fusco. *Folia* petiolata late ovata vel elliptica, ad c. 6.5 cm. longa et 3.5 cm. lata, apice abrupte acuminata, basi abrupte attenuata,

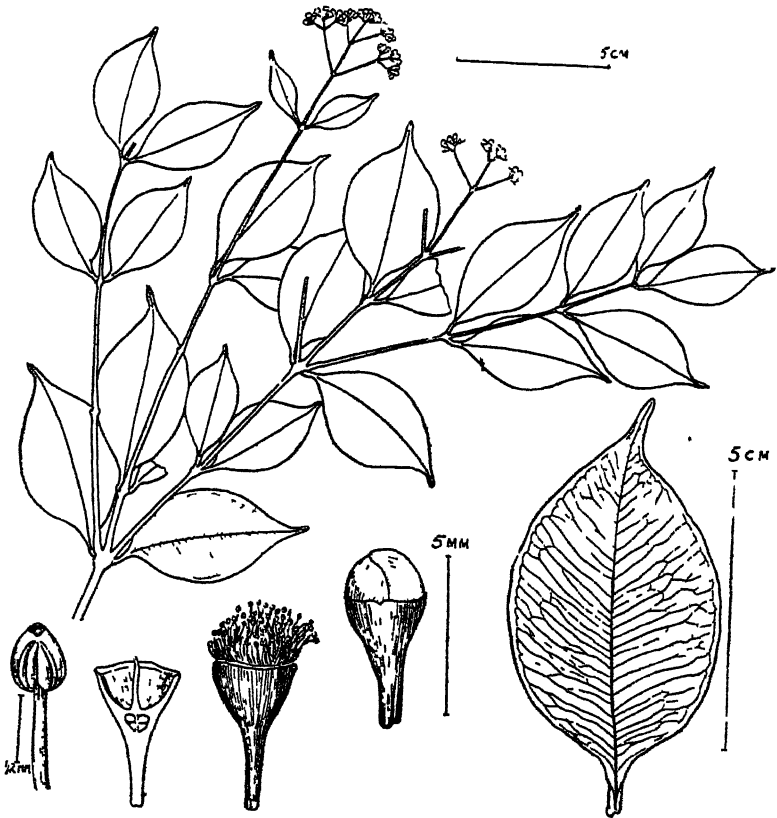


Fig. 14. *Eugenia taipingensis* HENDERSON Del: CHAN YORK CHYE

*nervis primariis* utrinque c. 10, tenuibus, utrinque prominulis, in venam marginalem e margine c. 1 mm. distantem conjunctis. *Paniculae* terminales ad c. 6 cm. longae et 4 cm. latae, densiflorae. *Flores* sessiles in apice ramulorum dense dispositi. *Calycis* tubus in alabastro anguste campanulatus, c. 4 mm. longus et 2-2.5 mm. latus, in stipitem c. 2 mm. longum productus, margine subtruncato. *Petala* calyptratim probabiliter decidua, glandulosa. *Stamina* ad c. 6 mm. longa, antherae c. 0.4-0.5 mm. longae, glandula satis conspicua. *Stylus* ad c. 5 mm. longus.

A low tree with spreading branches, 4.5-6 m. tall, stem 8-13 cm. diam. (*ex Kunstler*). *Twigs* smooth terete with pale whitey grey or brownish white bark or the youngest twigs with brown bark. *Leaves* coriaceous, broadly ovate or elliptic, sometimes tending to be obovate, up to c. 6.5 cm. long and 3.5 cm. broad, apex abruptly acuminate, acumen c. 1 cm. long, base abruptly narrowed and decurrent on petiole; upper surface drying dull brown or blackish brown, minutely punctate, lower surface usually reddish brown, with very minute and inconspicuous black gland dots, or none; midrib sunk above, raised below and slightly pustulate near base; *primary nerves* about 10 pairs, very slender and almost indistinguishable from secondaries and reticulations, raised and slender below, meeting in a slender and not conspicuous intramarginal nerve c. 1 mm. from margin; *petiole* 2-5 mm. long, black, wrinkled, channelled above.

*Inflorescence* terminal, paniculate, up to c. 6 cm. long and 4 cm. across, branchlets spreading, slender, angled, with brownish or greyish striate bark. *Flowers* crowded at ends of ultimate branchlets, sessile, bracteoles apparently very small and falling early; *calyx* tube in bud c. 4 mm. long and 2-2.5 mm. across mouth, striate when dry, narrowly campanulate, quickly contracted some way below mouth, then tapering gradually into a pseudostalk c. 2 mm. long, mouth truncate or wavy or at most with very obscure shallow lobes; *petals* probably falling as a calyptra, more or less agglutinated when dry, thick textured with conspicuous gland dots; *stamens* numerous, filaments slender, up to c. 6 mm. long, anthers c. 0.4-0.5 mm. long, connective gland conspicuous; *style* much stouter than filaments, c. 5 mm. long. *Fruit* unknown.

PERAK: Taiping, plains, *Wray 2703*, TYPE collection, holotype in Herb. Singapore; Taiping, within 100 ft., in open jungle, low wet ground, *Kunstler 8379*.

This species was included under *E. oleina* Wight (*E. myrtifolia* Roxb.) by King and presumably by Ridley, but it is very distinct from that species in its broader and more acuminate leaves with the nerves and reticulations raised above, and in its truncate calyx mouth.

*Eugenia* (§ *Syzygium*) *flosculifera* sp. nov. Fig. 15.

*Arbor* c. 40 m. alta. *Ramuli* teretes, laeves, cortice pallide, novelli fusci. *Folia* vulgo plus minusve obovata interdum elliptica vel oblongo-elliptica, ad c. 7 cm. longa et 3.5 cm. lata, apice abrupte acuminata, basi attenuata in petiolum decurrentia; *nervis primariis* utrinque ad c. 8, inter se 5–8 mm. distantibus, supra obscuris, subtus tenuibus sed distinctis, in venam intramarginalem a margine c. 3 mm. distantem conjunctis. *Petiolī* ad c. 1 cm. longi. *Inflorescentiae* terminales vel ex axillis foliorum superiorum, paniculatae, ad 9 cm. longae. *Flores* parvi, sessiles, in apice

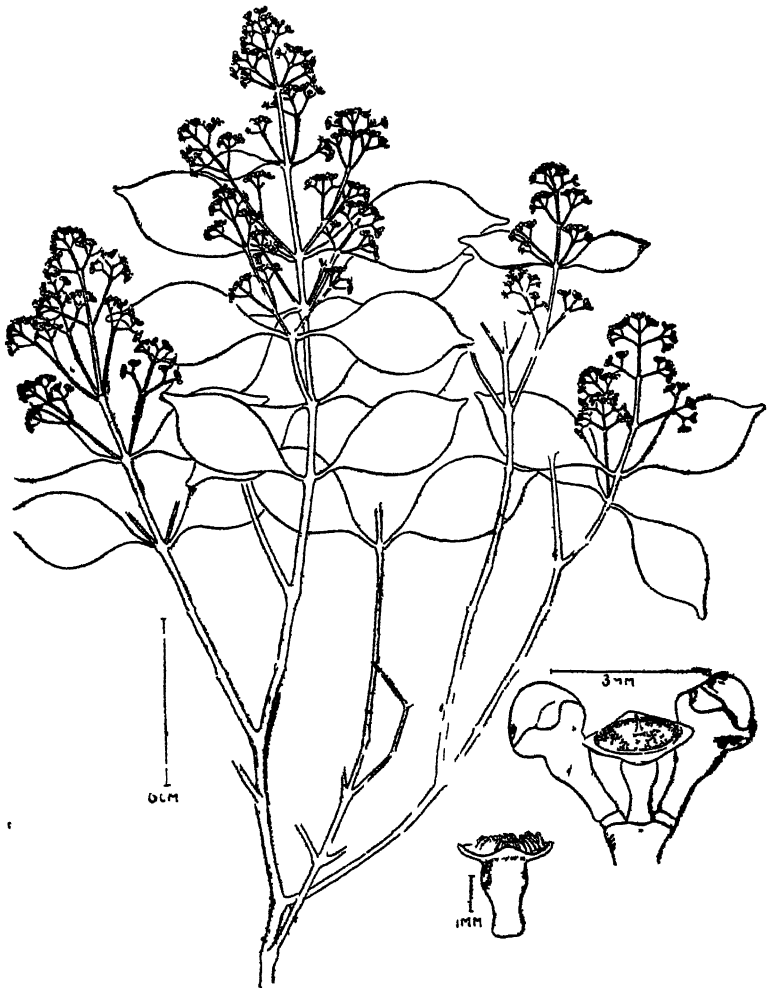


Fig. 15. *Eugenia flosculifera* HENDERSON Del: CHAN YORK CHYE

ramulorum 2 vel 3, alabastris c. 3 mm. longis. *Calyx* c. 2.5 mm. longus apice c. 1.75 mm. latus, lobis 4 late triangularibus obtusis vel subacutis, incurvatis, c. 1 mm. latis et 0.5 mm. altis, basi in stipitem c. 1 mm. longam attenuatus, supra ovarium abrupte contractus. *Petala* calyptrata. *Stamina* c. 16, 0.5–1 mm. longa, filamentis crassis, antheris plus minusve oblongis, 0.2–0.3 mm. longis, apice glandulosis. *Stylus* c. 0.5 mm. longus. *Ovarium* 2-loculare. *Fructus* late oblongus ad oblongo-obovoideus, ad c. 1.5 cm. longus et 1.5–1.75 cm. latus, apice depressus, umbilico conico 4–5 mm. diam., calycis margine minute coronato; pericarpium crassum, c. 5 mm. *Semen* 1, globosum, depresso-globosum vel obovoideum, cotyledonibus omnino conjunctis, ut pseudomonocotyledoneum.

A tree c. 40 metres tall, with steep narrow buttresses to c. 2 metres; crown large, spreading; bark light buff, slightly scaly flaky, smooth over large areas, slightly pustulate with scattered 3 mm. lenticels, otherwise entire; inner bark thick, pale brownish yellow with fine longitudinal sclerotic strands; wood pale brownish buff. Twigs rather slender, terete, smooth, bark pale whitey grey to very pale yellowish, somewhat polished, in places finely longitudinally cracked, sometimes the outer thin layer peeling off and showing a pale brown layer below; the very youngest shoots with brownish or reddish bark and often angled or channelled.

*Leaves* thinly coriaceous, usually obovate, sometimes elliptic or oblong elliptic, up to c. 7 cm. long and 3.5 cm. broad, but usually smaller, apex abruptly acuminate, acumen up to 1 cm. long, base long narrowed and decurrent on petiole; upper surface drying dull olivaceous brown or blackish brown, very minutely and almost invisibly punctate, lower surface paler brown or yellowish brown with rather sparse brownish gland dots; midrib sunk above in a narrow channel, raised below; primary nerves up to c. 8 pairs, often fewer, 5–8 mm. distant, hardly visible on upper surface, but if visible, slightly raised, fine and raised on lower surface, meeting in an intramarginal nerve c. 3 mm. from the slightly recurved margin; secondaries and reticulations invisible above, sufficiently distinct below but less conspicuous than primaries, reticulations lax; petiole up to c. 1 cm. long, drying dark, wrinkled, often finely glandular pustulate, narrowly channelled above.

*Inflorescences* terminal or from upper axils, paniculate, terminal panicles often fasciculate, up to 9 cm. long but usually shorter, primary branchlets ascending, up to c. 2 cm. long, secondary branchlets 5–7 mm. long, branchlets slender with brown striate bark sometimes dotted with paler glands. *Flowers* small, sessile or nearly so, in pairs or more usually in threes at branchlet ends, bracts and bracteoles

minute and not persistent; buds c. 3 mm. long. *Calyx* c. 2.5 mm. long, c. 1.75 mm. across lobes, tube brown or black when dry, finely wrinkled, lobes 4, broadly triangular, blunt or subacute, incurved, c. 0.5 mm. high and 1 mm. wide, tube more or less fusiform, suddenly contracted below lobes, swollen about ovary, then gradually narrowed to a pseudo-stalk c. 1 mm. long; *petals* pale brown when dry, calyptrate. *Stamens* about 16 in a single row on edge of disc, 0.5–1 mm. long, filaments stout, their upper part remaining sharply bent inwards until long after the flower opens; anthers more or less oblong, 0.2–0.3 mm. long, the apical connective gland conspicuous as a dark brown knob. *Style* c. 0.5 mm. long. *Ovary* 2-celled with few ovules in each cell.

*Fruit* pale shining green when ripe, broadly oblong to oblong obovoid, up to c. 1.5 cm. long and 1.5–1.75 cm. wide at widest point, apex depressed with a conical excavation 4–5 mm. diam., fringed with the minute calyx rim but without stamen or style remains; pericarp firm, green, slightly juicy, c. 5 mm. thick; seed one, globose or more or less depressed globose or obovoid, cotyledons dark blackish brown when ripe, testa thin, papery, loose, pale brown; cotyledons apparently completely fused, no commissure visible, their centre occupied by an intrusion of ? placental tissue which disappears when seed is fully ripe.

SINGAPORE: Reservoir Jungle, *SFN 36133* (Corner), TYPE collection, holotype in Herb. Singapore. Flowers in March.

A very peculiar species, which might better be placed in a new section of the genus, known definitely only from this locality. The size of the tree, the smallness of the flowers and the peculiar seed readily distinguish it from all others.

What appears to be the same or a closely allied species was collected by E. J. H. Corner, *SFN 30481* at Bukit Kajang, Kemaman, alt. 500 ft., but there are some differences in foliage and flower characters, and fruit of the Kemaman plant is not yet known.

*Eugenia* (§ *Syzygium*) *pseudoclaviflora* sp. nov. Fig. 16.

*Arbor* 6–7 m. alta. *Ramuli* teretes, ultimi tetragoni. *Folia* petiolata, lanceolata vel oblongo-lanceolata, basi attenuata, apice in acumen longum acutum attenuata, 4–8 cm. longa, 1.25–2.5 cm. lata, in sicco supra virescentia, subtus flavescentia, nervis primariis utrinque c. 10, fere obscuris. *Cymae* axillares, sessiles vel breviter pedicellatae. *Flores* sessiles. *Calycis* tubus in sicco clavatus, parte limboidea cyathiformi, 4-dentata, basi in stipitem brevem attenuatus, ad 12.5 mm. longus. *Petala* calyptratim decidua



Fig. 16. *Eugenia pseudoclaviflora* HENDERSON Del: CHAN YOKA CHYE

vel interdum libera. *Stamina* ad 4 mm. longa. *Stylus* ad c. 8 mm. longus. *Ovarium* 3-vel 2-loculare. *Fructus* ignotus.

A tree 6-7 metres tall. Two-year old *twigs* slender, terete, with dull blackish brown or reddish brown finely cracked bark; one year old twigs very slender, paler than the older twigs or not.

*Leaves* 4-8 cm. long, 1.25-2.5 cm. broad, lanceolate or oblong-lanceolate, base long narrowed, apex long acuminate or almost caudate acuminate, acumen acute; upper surface dull, smooth, punctate, drying greenish, lower surface drying yellowish, not gland dotted or punctate, margin somewhat thickened; midrib sunk above in a narrow channel, raised and conspicuous below, otherwise the nervation very indistinct or invisible above, only a little more conspicuous below and then only in young leaves; *primary nerves* c. 10 pairs, spaced, meeting in a very obscure intramarginal nerve close

to the leaf margin, reticulations almost or quite invisible; petiole blackish brown, wrinkled, up to c. 5 mm. long.

*Cymes* short, axillary, condensed, sessile or nearly so, shorter than leaves. *Flowers* sessile. *Calyx* narrowly clavate, the limb slightly cyathiform, the tube long narrowed, contracted at base into a short pseudostalk, slightly ribbed and finely rugulose-pustulate, c. 12.5 mm. long; lobes 4, broadly rounded, shallow, c. 0.4–0.5 mm. high. *Petals* usually calyptrate, the calyptra subpersistent, or the petals occasionally free, also subpersistent. *Stamens* up to 4.5 mm. long, filaments slender, anthers broadly elliptic or ovate, c. 0.5 mm. long and 0.3–0.4 mm. wide, connective gland inconspicuous. *Style* c. 8 mm. long, rather stout, more or less cylindric or very slightly fusiform in lower half, upper half tapering gradually upwards. *Ovary* 3 or 2 celled. *Fruit* unknown.

PAHANG: Track to Gunong Tahan, c. 1,000 ft., on ridge, SFN 31755 (*Kiah*), TYPE collection, holotype in Herb. Singapore. Mature flowers in July.

The inflorescence of this species is very like that of *E. claviflora* Roxb., but the flowers are shorter and stouter; the foliage resembles that of *E. attenuata* Koord. & Valet., but the inflorescence and flowers differ considerably from that species.

#### §Fissicalyx, sect. nov.

Stamina a tubo calycis supra discum orta; post anthesin tubus calycis in lobas irregulares longitudinaliter fissus.

Calyx in bud c. 2.5 cm. long and 1 cm. broad; primary nerves c. 15 pairs, intramarginal nerve 0.5–0.7 cm. from margin

*Symingtoniana*.

Calyx c. 4 cm. × 3 cm.; primary nerves 18–25 pairs, intramarginal nerve 2–3 mm. from margin *Watsoniana*.

#### *Eugenia* (§ Fissicalyx) *Symingtoniana* sp. nov. Fig. 17.

*Arbor* c. 3–13 m. alta. *Ramuli* teretes. *Folia* elliptica ad elliptico-oblonga, interdum oblongo-lanceolata, apice abrupte breviter acuminata vel interdum abrupte caudata, basi cuneata, ad 20 cm. longa et 10 cm. lata; *nervis primariis* utrinque ad c. 15, 0.75–2 cm. distantibus, supra impressis, subtus prominulis, in venam intramarginalem 0.5–0.7 cm. e margine conjunctis; petiolis ad 1 cm. longis. *Flos* sessilis, 1 vel interdum 2. *Alabastri calyx* subglobosus ad obovatus, 2.5 cm. longus et 1 cm. latus, deorsum in stipitem brevem attenuatus; lobis 4; post anthesin tubo calycis in aliquot lobas irregulares longitudinaliter fisso. *Petala* 4, libera, orbiculares, c. 5 mm. diam. *Stamina* e tubo calycis supra discum orta, filamentis numerosissimis, c. 1.5 cm. longis. *Stylus* c. 1 cm. longus. *Ovarium* 2-loculare, multiovulatum.

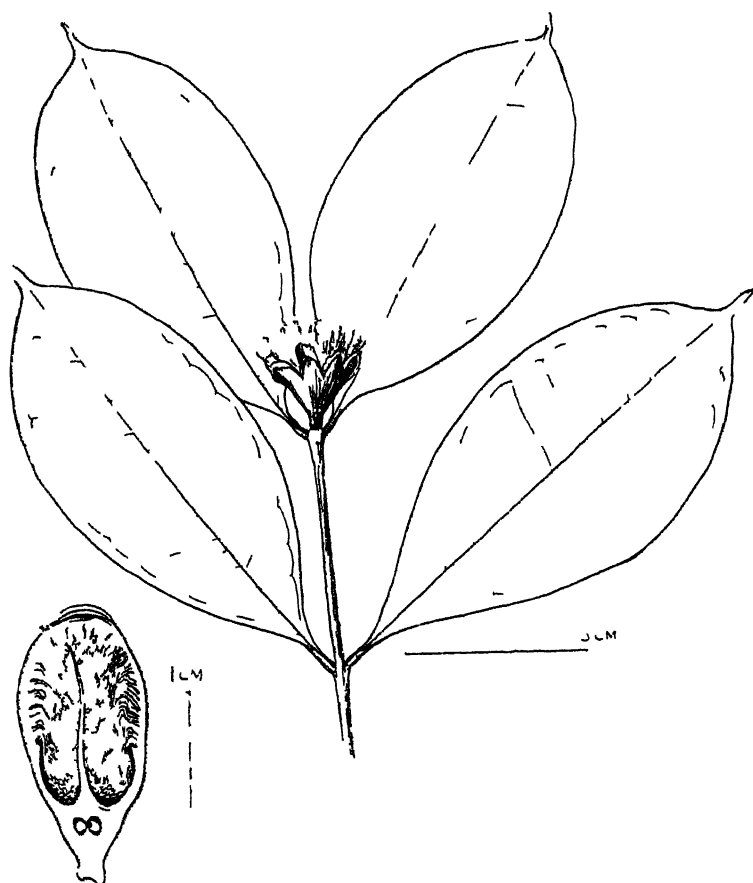


Fig 17 *Eugenia Symingtoniana* HENDERSON Del CHAN YOK CHYE

A tree c 3-13 metres tall. *Twigs* terete, bark drying whitish or greyish white, smooth, with a slight tendency to flaking. *Leaves* elliptic to elliptic oblong, occasionally oblong lanceolate, apex abruptly short acuminate or sometimes abruptly caudate, base cuneate and more or less decurrent on petiole; up to 20 cm. long and 10 cm. broad; *primary nerves* up to about 15 pairs, 0.75-2 cm. distant, impressed above, prominent but not thick below, leaving midrib at an angle of 80-85 degrees and running nearly straight, or more usually curving gently up to the intramarginal nerve, which is 0.5-0.7 cm. from leaf margin, with a much fainter one c. 0.2 cm. from the margin; secondaries and reticulations faint above, easily visible below, usually a well defined secondary between each pair of primaries, reticulations rather lax; upper surface drying fuscous dull or greyish

brown, lower surface a warmer reddish brown; *petiole* stout, drying black, deeply channelled above, up to c. 1 cm. long.

*Flowers* usually solitary or occasionally in pairs at ends of branches, sessile; *calyx* in bud subglobose to obovoid, c. 2.5 cm. long and 1 cm. wide when mature, more or less campanulate after anthesis, slightly swollen about ovary, constricted at base into a short stout pseudostalk; surface of tube smooth or longitudinally striate when dry; lobes ?4, short, round, gland dotted, but the tube splitting deeply after anthesis into several deep irregular triangular false lobes. *Petals* ?4, free, thin, suborbicular with a short broad claw, c. 5-6 mm. diam., apparently often subpersistent, as are the calyx lobes, and adherent to the apices of the rolled back false calyx lobes. *Disc* lining calyx tube to c. 0.5 cm. above ovary. *Stamens* borne on the whole surface of the calyx tube above disc, the tube being produced c. 1 cm. above disc; filaments very numerous, slender, flattened below and gradually tapering upwards, c. 1.5 cm. long; bases of the fallen stamens giving the inner surface of the rolled back false calyx lobes a tessellate appearance; anthers oblong, c. 0.6-0.7 mm. long, connective gland inconspicuous; *style* c. 1 cm. long or a little longer. *Ovary* 2-celled with many ovules.

PERAK: Sungai Sah, Kledang Saiong, *Forest Dept. FMS 14721*, flowers in March, Malay name *Kelat Jambu*; Sungai Sah, Kinta, *Forest Dept. FMS 28055*, flowers in March, Malay name *Kelat*.

PAHANG: Bukit Goh Forest Reserve, Kuantan, *Forest Dept. FMS 3136*, TYPE collection, holotype in Herbarium of Forest Research Institute, Kepong, flowers in March, Malay name *Kelat Kuning*; Baloh, Kuantan, *Forest Dept. FMS 3719*, flowers in April, Malay name *Kelat Jambu*; Gunong Rokam, Pulau Tioman, 2,500 ft., *SFN 18779 (Nur)*, flowers in May.

A fruiting specimen without flowers has been collected at Sungai Paka, Trengganu, *Forest Dept. FMS 26723*. There is little doubt that it belongs to this species, but the fruits are in poor condition and have not been included in the description of the species. A note upon them follows:

The larger of the two fruits on the sheet is in a rotten and fragmentary condition. Its diameter may have been c. 2.5-3 cm., surface smooth and shining, apex with the remains of the calyx tube and the recurved calyx lobes, forming a crown c. 1.5 cm. diam. The other fruit is much smaller, c. 1.5 cm. diam., oblong globose with a truncate apex completely occupied by the calyx remains.

A collection made at Ulu Brang, Trengganu, c. 800 ft. alt., *SFN 33750 (Moysey & Kiah)* possibly belongs here, but only immature fruits are available.

**Eugenia (§ Fissicalyx) Watsoniana** sp. nov. Fig. 13.

*Arbor* ad c. 10 m. alta. *Ramuli* teretes. *Folia* coriacea, anguste elliptica ad oblongo-elliptica, basi cuneata, apice abrupte brevique acuminata vel breve acuta, ad c. 20 cm. longa et 8 cm. lata, *petiolis* c. 1-1.5 cm. longis; *nervis primariis* utrinque 18-25, 0.75-1.5 cm. distantibus, supra impressis, subtus prominulis, in venam intramarginalem 2-3 mm. e margine conjunctis; *nervis secundariis* supra obscuris, subtus inconspicuis. *Flos* ?solitarius, terminalis, sessilis. *Calycis* tubus campanulatus, deorsum in stipitem

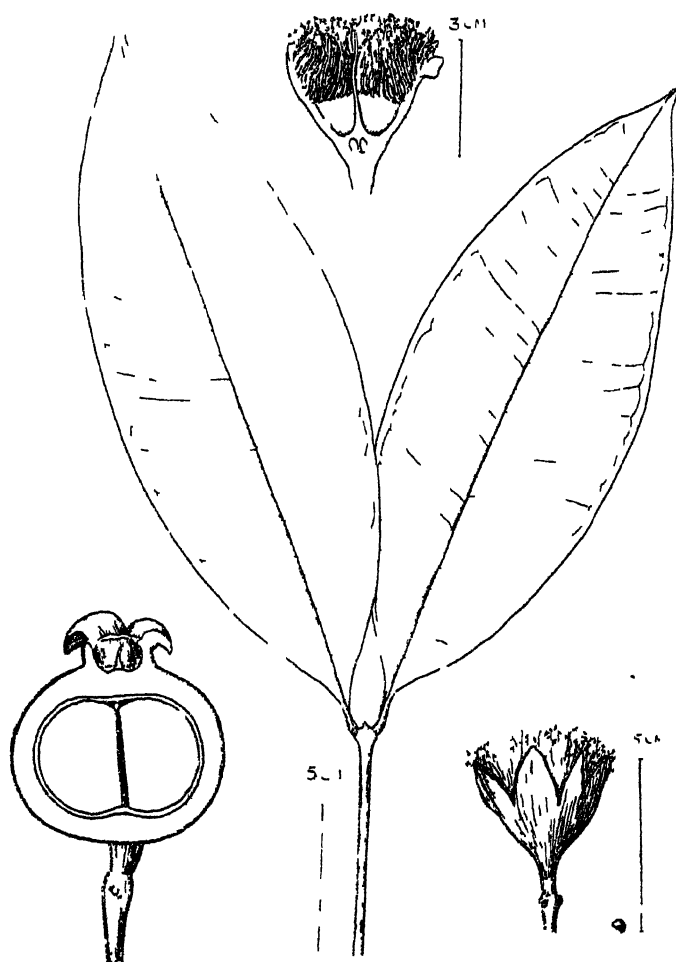


Fig. 18. *Eugenia Watsoniana* HENDERSON Del: CHAN YOEK CHYE

brevissimam crassam attenuatus, c. 4 cm. longus et 3 cm. latus, lobis 4, rotundatis; post anthesin tubo calycis in 6-7 lobos irregulares longitudinaliter fisso. *Petala* ignota. *Stamina* numerosissima, e tubo calycis supra discum orta, filamentis 1.5-2 cm. longis. *Stylus* c. 3 cm. longus. *Ovarium* subtus 2-loculare, supra 4-loculare, multiovulatum. *Fructus* globosus vel depresso-globosus, 5-6 cm. diam., margine et lobis crassis reflexis calycis coronatus.

A tree up to c. 10 metres tall. *Twigs* terete with pale bark, almost white or greyish white, smooth or slightly flaky. *Leaves* more or less coriaceous, narrowly elliptic to oblong elliptic, base narrowed, apex very abruptly and shortly acuminate or shortly acute, up to c. 20 cm. long and 8 cm. broad, petiole rather stout, usually definitely channelled above, c. 1-1.5 cm. long, the lamina occasionally somewhat decurrent upon it; *primary nerves* 18-25 pairs, 0.75-1.5 cm. apart, more or less impressed above, prominent below but not thick, nearly straight or curving gently up to a well marked intramarginal nerve usually 2-3 mm. from leaf margin; secondaries and reticulations usually almost invisible above, not conspicuous below; upper surface drying dull greyish or fuscous brown, lower surface reddish brown.

*Flowers* apparently solitary and terminal, sessile, large; *calyx* more or less campanulate, shortly narrowed at base to a very short stout pseudostalk, texture thick and leathery, smooth or faintly longitudinally ribbed, c. 4 cm. long and 3 cm. across in bud, lobes 4, short, broad and rounded, the calyx tube after anthesis splitting into 6 or 7 rather irregular lobes 1-1.5 cm. long; *petals* not seen, probably falling very early; *stamens* very numerous, borne on the surface of the calyx tube above the disc, filaments very slender, c. 1.5-2 cm. long, anthers oblong, c. 0.7 mm. long, connective gland inconspicuous; *style* stouter than filaments, c. 3 cm. long; *ovary* 2-celled below, 4 celled above, multiovulate.

*Fruit* globose or depressed globose, 5-6 cm. diam., smooth or very faintly vertically ribbed when dry, crowned by the massive remains of the calyx tube 6-9 mm. tall and c. 2 cm. diam., along with the recurved false calyx lobes; pericarp hard and woody when dry, 5-7 mm. thick, testa nearly 1 mm. thick; cotyledons nearly equal, probably sessile, their inner faces apparently almost plane or slightly concave, attached to the hypocotyle near their centres.

SELANGOR: Sungai Lallang Forest Reserve, 1,000 ft., Forest Dept. FMS 22928, TYPE collection, holotype in Herbarium of Forest Research Institute, Kepong; "A small straggling tree, 15 ft., in damp stream valley, flr. yellow"; flowers in March; Kanching Forest Reserve,

*Forest Dept. FMS 9563*, flowers in February, *Forest Dept. FMS 5795*, fruit in January; Rantau Panjang Forest Reserve, *Forest Dept. FMS 595*, fruit in August.

A new section has had to be created for this and the preceding species. The longitudinal splitting of the calyx after the flower opens has not, so far as I can discover, been described in *Eugenia*, nor has the much more peculiar character, that of the stamens borne on the calyx tube above the disc, been found in *Eugenia*, or indeed in any other genus of Myrtaceae.

These two species are obviously very closely allied, but in *E. Symingtoniana* the stamens are borne over a wider area of the calyx tube than in *E. Watsoniana*, the flowers are smaller, and the leaves have fewer primary nerves, with the intramarginal nerve further from the leaf margin.





# THE GARDENS' BULLETIN

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# THE GARDENS' BULLETIN SINGAPORE

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Part 1

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## THE GENUS *EUGENIA* (MYRTACEAE) IN MALAYA

by

M. R. HENDERSON, F.L.S.

*Eugenia* Linn. in its widest sense is a very large genus spread over the tropics and subtropics of the New World and the tropics of Asia, Africa and Australia, with one species reaching as far as New Zealand, the bulk of the Old World species being in Asia.

As Merrill and Perry point out, the genus, with some 2,500 binomials, has become unwieldy, but attempts to split it up into more easily handled groups have not met with conspicuous success, for the limits of such groups are very difficult to define. The Asiatic species have been considered to fall into two genera, *Syzygium* Gaertn. and *Jambosa* DC., but although the extremes of these groups are distinct enough, they merge into one another in such a way that no clear dividing line can be found.

The most recent work on Malaysian *Eugenia* is that of Merrill and Perry on the Bornean species (Mem. Amer. Acad. Arts and Sci., XVIII, part 3) and here and in earlier papers (Journ. Arn. Arb., XVIII, XIX) they give their reasons for maintaining *Syzygium* for the majority of the Asiatic species with *Acmena* DC. and *Cleistocalyx* Bl. as separate genera, *Acmena* characterised by fruit and anther characters, *Cleistocalyx* by its calyptrate calyces.

Their arguments for separating *Syzygium* from *Eu-eugenia* are based mainly on the structure of the seed. *Syzygium*, they say, has the cotyledons separate and distinct while in *Eu-eugenia* they have grown together and are

mechanically inseparable. The second point is that the testa in *Syzygium* is adherent to the pericarp while in *Eu-eugenia* it is free from it and adherent to the cotyledons.

I propose to examine the second of these statements, the less important of the two, first.

Merrill and Perry are careful to imply that their conclusions were drawn from dried material. I have examined dried fruit of many Malayan species and find that in a number of cases the testa does strip with the pericarp and leave the naked cotyledons, but in other cases it does not. In some of the large fruits of the "Jambosa" group, for example, the seeds lie loosely within the pericarp and the rather thick testa remains closely adherent to the cotyledons. Even in *Syzygium* proper the removal of the pericarp of the dried fruit does not always entail the removal of the testa. In boiled up fruits and fruits preserved in alcohol it seems to be a matter of the methods of handling the specimen whether the testa strips with the pericarp or not. If there are any characters here on which generic distinctions can be based, they should be apparent in living material and I have therefore examined fresh fruit of as many species as possible. I find that in the majority of local species the seed coat remains on the cotyledons when the pericarp is removed. I have not been able to examine fresh fruit of many species of *Eu-eugenia*, but so far as I have gone, the two groups are alike in this respect.

The degree of adherence of the seed coat to the cotyledons varies greatly within the section *Syzygium*. In such species as *E. javanica*, *E. malaccensis*, *E. aquea*, etc., where the seed or seeds lie loosely within a cavity in the thick pericarp, the testa is a thick pithy layer removable only with difficulty from the rugose surface of the cotyledons. Other species, such as *E. grandis* and *E. subdecussata*, have a comparatively thick pithy seed coat adherent to the smooth surfaced cotyledons. Innumerable seeds of the former may be picked up in the Botanic Gardens Singapore at appropriate seasons of the year, every one with the pericarp completely removed by bats, but with the testa intact. I have watched a *berok* monkey (*Macacus nemestrina*) nibbling the fruits of *E. subdecussata*. Here again the slightly sweet pericarp is neatly removed and the seed thrown away with undamaged testa. Some species have a somewhat brittle seed coat which can be removed only in small pieces, while others have a thin, more or less membranous covering which is easily slipped off, very like that of *E. uniflora* L. or *E. apiculata* DC., both New World species. Germinating seeds of *Syzygium*, found on the

ground under the parent tree, usually have the testa more or less intact, the pericarp having rotted away.

It seems apparent therefore that the seed coat and its degree of adherence to the cotyledons can hardly be used as a basis for generic distinctions.

The pseudomonocotyledonous nature of the seed of *Eu-eugenia* appears to be a character of great value, but unfortunately it does not hold throughout the group. It appears that all gradations from completely fused to completely free cotyledons are to be found in *Eu-eugenia*. *E. Michellii* Lam. may have a seed consisting of a single mass of tissue, the cotyledons not separating on germination, or the opposing cotyledon faces may be fused together only partially. *E. apiculata* DC. and *E. myrtifolia* (non Roxb.). both New World species, have completely free cotyledons and the seed structure in these species is not essentially different from that of a typical *Syzygium*. In *E. bracteata* Roxb., an E. Indian species placed in *Eu-eugenia*, the cotyledons are fused from one quarter to one third of the area of their opposing faces, while in *E. Muellieri*, a local species of the section *Syzygium*, seeds have been found with a small area of the opposing faces fused. At least one local species of *Syzygium* has the cotyledons fused into a single mass and another has them so locked together that it is doubtful if they can be separated without fracturing the tissues. In neither of these species do the cotyledons separate on germination.

It appears therefore that the pseudomonocotyledonous nature of the seed can not be regarded as a good generic character. In some cases it cannot be regarded even as a specific character. A similar state of affairs has been pointed out in Cupuliferae by A. Camus—"Soudure des Cotylédons dans le genre *Lithocarpus* Blume" in Bulletin Muséum National d'Histoire Naturelle, XIV, vi, 461 (1942). Here the fusion of the cotyledons in *Lithocarpus* is frequent, but it is a specific character and does not occur throughout any of the subgenera.

The fruits of *Syzygium* are usually one-seeded, with equal or nearly equal cotyledons which are often green and conspicuously gland dotted, lying side by side, superposed, or, more rarely, obliquely. The opposing faces may be plane, somewhat concave, or folded and interlocked, depending on the method of attachment of the cotyledons to the hypocotyle. The hypocotyle is usually short, the plumule and radicle small, lying near the centre of the inner faces, or sometimes near the periphery. Polyembryony occurs in some species.

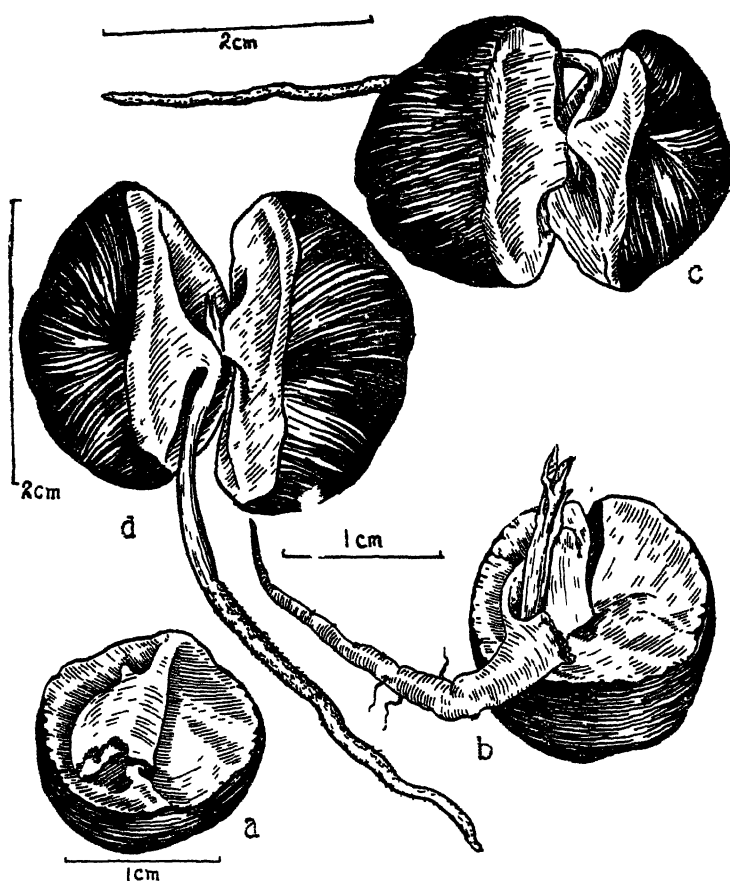


Fig. 1. a, b, cotyledons of *E. malaccensis* from a germinating seed; c, d, germinating seeds of *E. javanica*. The broad stalks of the cotyledons are clearly seen.

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In the large fruited "Jambosa" group, *E. malaccensis* for example, the cotyledons are attached to the hypocotyle by stalks which consist of broad, flattened, triangular bands of tissue, arising from the inner faces of the cotyledons, parallel with them for the greater part of their length, then curving at right angles to meet the hypocotyle. The excavations in the cotyledon faces to accommodate these stalks make the structure apparently very complicated, but it becomes perfectly clear when the seeds germinate and the cotyledons begin to move apart. (Fig. 1).

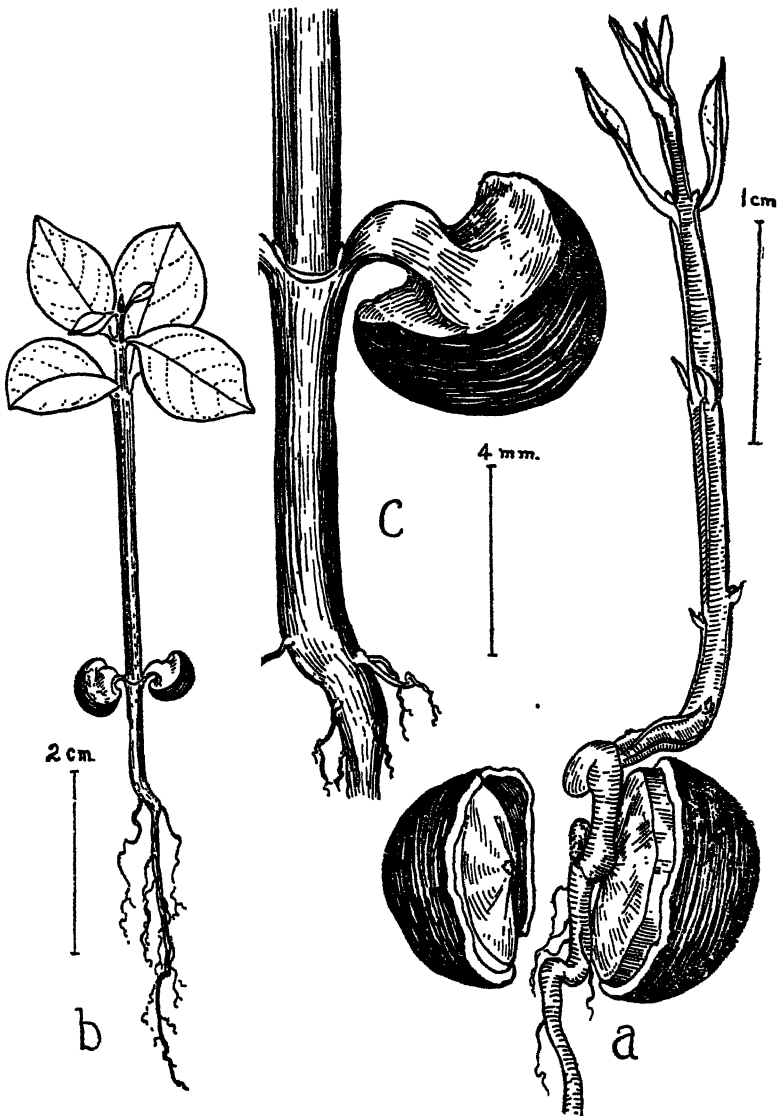


Fig. 2. a, germinating seed of *E. Ngadimaniana*, showing sessile cotyledons, thick persistent testa, and angled shoot; b, c, *E. conglomerata*, seedling showing stalked cotyledons and epigeal germination.

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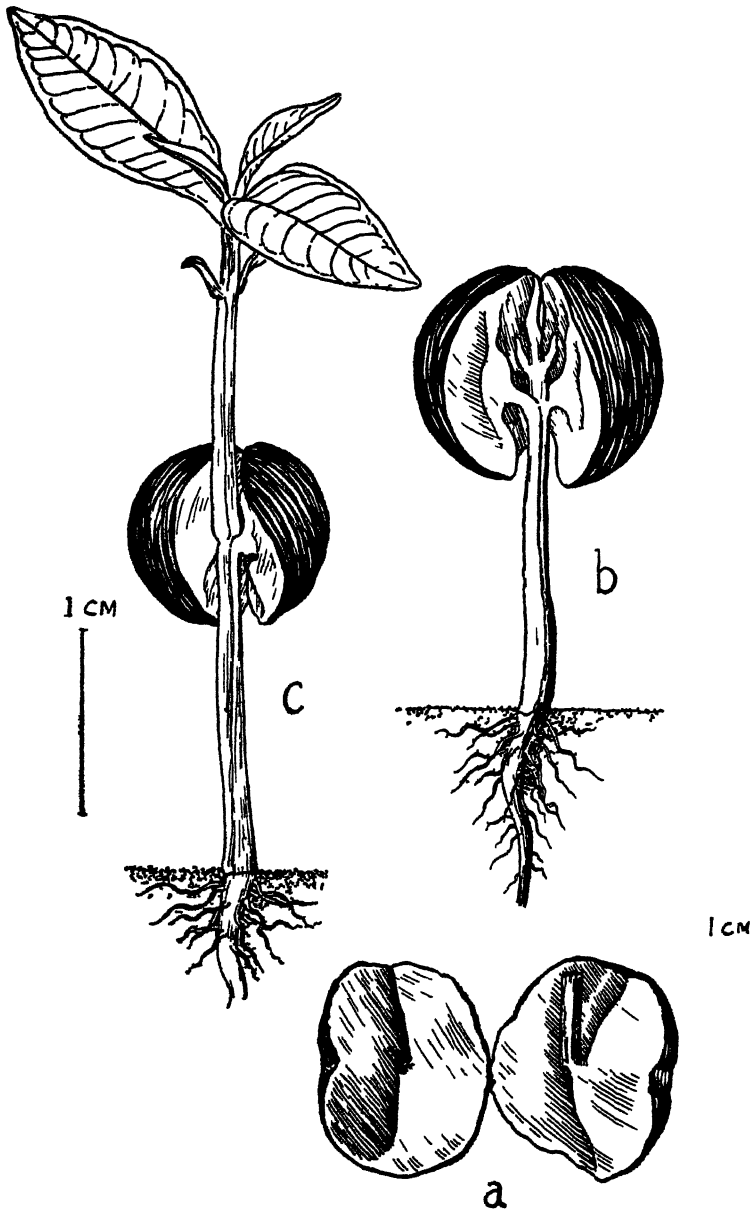


Fig 3. *E. pustulata*, a, cotyledons showing conspicuous hypocotyle;  
b, c, seedling showing epigeal germination.

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The same type of structure in a less complicated form is met with in many of the smaller flowered species. Here the stalks are much shorter and there is much less excavation and folding of the cotyledon faces, the faces usually being nearly plane except for an excavation under each stalk and the radicle and plumule. Other species of *Syzygium* have "sessile" cotyledons attached directly to the hypocotyle and leaving a small circular scar when detached. (Fig. 2).

Normally the hypocotyle, plumule and radicle are small and completely hidden between the cotyledons, but in a number of species the hypocotyle is elongated and reaches the surface of the seed and is accommodated in a deep fold in the cotyledon faces. The Clove (*E. aromatica*), *E. cerina*, *E. polyantha*, *E. conglomerata*, *E. attenuata*, are some of the species which have this type of seed. (Fig. 3).

In a few local species the structure of the seed is very different. In *E. claviflora*, for instance, the cotyledons are closely adherent. There is a definite line or commissure visible on the outside of the seed, but the cotyledons can be separated only by force, and although they do not appear to be fused together, they are closely interlocked by irregular rounded projections and depressions on the inner faces, and separating them usually entails some fracture of the tissues. A large part of the interior of the seed is occupied by a mass of brown tissue ramifying in all directions through the lighter coloured tissue of the cotyledons. This brown mass appears, on sectioning the seed, to be continuous with the testa. The radicle and plumule are not visible when the seed is broken or cut open, and on germination the cotyledons do not move apart but remain as a solid mass until long after the seedling is well established. In this respect the germination is very similar to that of *E. Michelii* Lam. (Fig. 4).

In *E. flosculifera*, a species known from Singapore and perhaps from Kemaman, the seed structure is even more peculiar. The fruit is like a miniature "Jambosa" fruit in that the pericarp is comparatively thick and the seed small. Ripe seeds appear to have the cotyledons completely fused together and no line of demarcation is visible, nor can the cotyledons be separated. The young seed is a green hollow ball with no indication of separate cotyledons, the interior face of the hollow with irregular rounded knobs and the hollow filled with a colourless gummy substance. The completely ripe seed is a mass of dark brown tissue with an irregularly shaped hollow of approximately one quarter of its volume, communicating with the exterior of the seed.

The radicle and plumule are not visible. On germination the cotyledons do not separate. The structure appears similar to that of *E. claviflora*, but carried further towards complete fusion of the cotyledons.

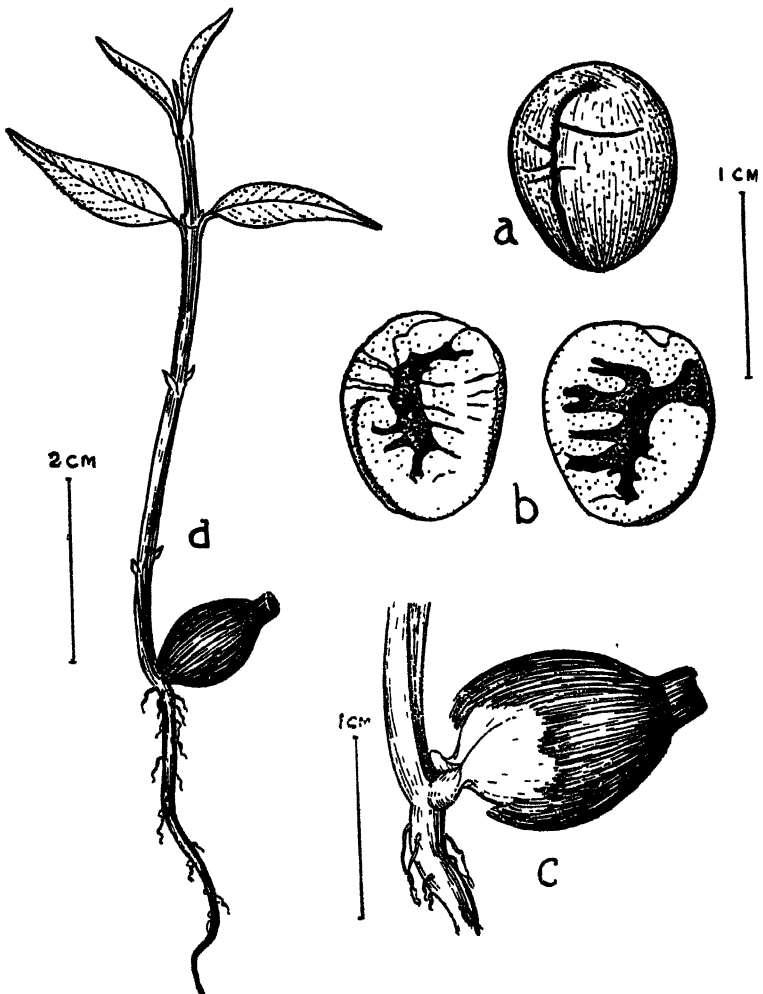


Fig. 4. *E. claviflora*, a, seed; b, separated cotyledons; c, d, seedling showing the cotyledons still unseparated although the seedling is well grown.

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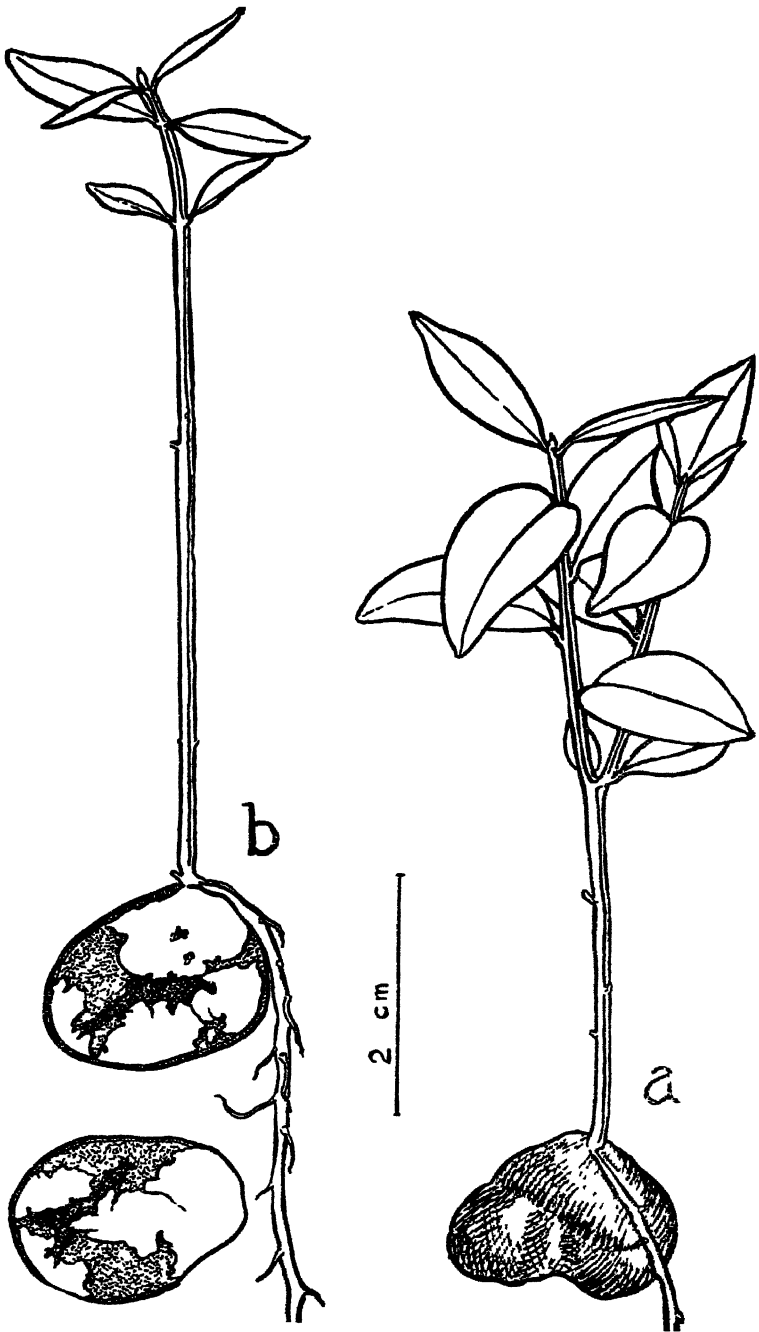


Fig. 5. *E. Cumingiana*, a, seedling with unseparated cotyledons;  
 b, seedling with seed cut open.

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Merrill and Perry (Journ. Arn. Arb., XIX, 12 (1938)) reinstate *Acmena* DC. for a small number of species characterised by the pseudomonocotyledonous nature of the seed and the divaricate anther sacs opening by terminal slits or pores. *Eugenia Cumingiana* Vidal (*Acmena acuminatissima* (Bl.) Merr. and Perry) is the only representative of this section in the Malay Peninsula. Fresh seed of this species shows a structure very similar to that of *E. claviflora*. The cotyledons appear to be completely fused and no line of demarcation is visible. The interior of the seed is occupied by a ramifying mass of brown tissue which appears to be continuous with the testa, and there is no separation of the cotyledons on germination. (Fig. 5).

The other generic segregate reinstated by Merrill and Perry and occurring in the Peninsula is *Cleistocalyx* Bl. This is characterised by the calyptrate nature of the calyx. Our only representative is *E. operculata* Roxb., which has a seed structure similar to that in those species of *Syzygium* in which the hypocotyle is elongated to reach the periphery of the seed.

A new section, *Fissicalyx*, has had to be erected for two closely related species in which the flower structure departs very markedly from that normal in *Syzygium*, or even in *Eugenia* sens. lat. In *Fissicalyx* the calyx tube is prolonged far above the margin of the disc, and the stamens are scattered over its inner surface. The fruit appears to be of the normal *Syzygium* type.

It seems very improbable, therefore, that a satisfactory basis for splitting *Eugenia* is to be found in seed characters. On such a basis not only would further groups have to be segregated from *Syzygium*, as defined by Merrill and Perry, but *Eu-eugenia* itself would have to be split. The problem is a difficult one and probably can be solved only by someone who can undertake the enormous task of monographing the entire genus. Either *Eugenia* must be kept in its widest sense, which might necessitate inclusion of such closely related genera as *Aphanomyrtus*, and then it becomes more unwieldy than ever, or numerous small genera must be segregated from it. If the Old and New World species are to be separated, better characters might be found in the structure of the inflorescences and flowers.

A further complication is that, as Merrill and Perry point out in Mem. Amer. Acad. Arts and Sci., XVIII, 135, *Syzygium* is not the oldest available name for the group they have placed under that name. *Caryophyllus* Linn. (1754) is older, but Merrill and Perry use *Syzygium* Gaertn. (1788) because it is better known and because fewer name changes are involved. They recommend *Syzygium* for conservation against *Caryophyllus*. But the practice of

using a later name in the hope that at some future date it may be conserved against an older valid name seems a somewhat dubious procedure.

Finally, objections to the splitting of such a well known genus as *Eugenia* are certain to be forthcoming from foresters, agriculturists, horticulturists and others who are perfectly familiar with the name *Eugenia* but who would resent the substitution of a crop of unfamiliar and not too euphonious names. Their point of view, that generic names should be tampered with as little as possible is, I think, sound. Taxonomists appear apt to forget that their work is not an end in itself, but is the basis upon which all economic work must stand, and the changing of generic names, unless absolutely necessary, hinders and confuses that work. It is bad enough to have to change so many specific names, and indeed protests have been made against this, but such changes are in a different category and are inevitable when any large group of plants is critically examined and compared with those from neighbouring countries.

For the purposes of this revision, therefore, *Eugenia* is retained in its wide sense and the following divisions are proposed as Sections:

1. Calyx tube produced above ovary:
  2. Stamens on the margin of the disc lining the calyx tube, calyx tube not splitting longitudinally after anthesis:
    3. Anther cells not divaricate, usually elongate, opening by longitudinal slits:
      4. Calyx calyptrate, the upper part falling as a lid . . . . . § *Cleistocalyx*
      4. Calyx not calyptrate; if lobed, the lobes free . . . . . § *Syzygium*
    3. Anther cells globose, divaricate, opening by terminal slits . . . . . § *Acmena*
  2. Stamens on inside of calyx tube above disc, calyx tube splitting longitudinally after anthesis . . . . . § *Fissicalyx*
1. Calyx tube not produced above ovary . . . . . § *Eu-eugenia*

Many authors have stressed the difficulty of defining the species of *Eugenia* and of giving verbal descriptions which convey a clear idea of the differences between closely related species—differences which may be quite obvious when specimens are compared in the herbarium, or when living trees are examined.

Gagnepain in Bull. Soc. Bot. Fr., 1917, gives a long and detailed account of the characters of *Eugenia* and the use he makes of them in his account of the genus in Fl. Gen. Indo-Ch., II, 796 (1920). With some of his conclusions I am not in agreement, especially his use of calyptrate petals as a diagnostic character.

The characters which I have found of use in the herbarium and which I have depended upon in this revision are:—

1. The shape of the calyx tube, presence or absence of lobes and shape and size of lobes, presence or absence of pseudostalk. The shape of the calyx tube or of the complete unopened bud just before the petals expand or drop is of great importance and practically constant in each species. The majority of species have a campanulate, obconic or funnel shaped calyx tube narrowed abruptly or gradually to a pseudostalk which is a part of the calyx and not a pedicel. When a pedicel is present the articulation between it and the pseudostalk is evident. In other species the calyx tube is clavate, or very much longer than wide, narrowed gradually to the base or rather suddenly contracted below the ovary and then narrowing gradually (peg-shaped). A few species have a more or less fusiform calyx tube, swollen about the ovary and contracted above and below it. The pseudostalk may be well defined or not. Some of the very small flowered species have an urceolate calyx tube, rounded at the base and without pseudostalk, and often slightly contracted just below the mouth. After anthesis the shape of the calyx tube may alter considerably and in some species it opens out and becomes an almost flat disc.

2. The lobing of the calyx mouth is regarded as a constant and reliable character. All degrees of lobing may be present, the extreme case being where the margin of the calyx is truncate. The lobes may be deep, broad and rounded, broad and shallow, short teeth, or merely undulations of the calyx rim. In *Cleistocalyx* the whole of the upper part of the calyx falls as a lid. The lobes may be persistent or fugacious, either remaining throughout the whole life of the flower and appearing on the apex of the fruit, often enlarged, or dropping off soon after the flower has expanded and giving the appearance of a truncate or wavy calyx rim.

3. The plan of venation of the leaves is very constant for each species. It is best seen in dried specimens and may be classified roughly as follows:—

“(a) The primary veins much more prominent than the secondaries and quite distinct from them, well spaced and uniting in an intramarginal

- loop or nerve, with often a fainter intramarginal nerve closer to the leaf margin.
- (b) Primary veins very numerous and close together, not or hardly distinguishable from the secondaries, or only to be distinguished from them at their junction with the intramarginal nerve. An intramarginal nerve is almost always present, but it is often very close to the leaf margin and inconspicuous.
  - (c) Primary veins fine and close together but quite distinct from any secondaries that may be visible.
  - (d) Primary and other veins very faint or invisible.

The veins, including the finer reticulations, are usually more prominent on the lower surface of the leaf than above, but in several species the venation is raised above in a conspicuous manner.

Gland dotting may take the form of small black dots, minute sunk pits, or sometimes slightly raised pustulations, and this character appears to be reasonably constant in any one species, but it seems to vary somewhat with the age of the leaf.

4. The size, complexity, denseness or laxness of the inflorescence, and the relative stoutness or slenderness of its branches, are of considerable importance. All degrees of complexity may be met with, from solitary axillary flowers or short cymes to much branched axillary or terminal panicles. The position of the inflorescence, whether terminal or axillary, that is, from the youngest twigs, or from the older wood below the leaves, appears to be nearly constant in each species.

5. The shape of the twigs, whether terete, angled, or winged, and the colour of their bark and whether it is smooth or flaky are characters which although apparently trivial are remarkably constant. The same applies, with somewhat less force, to the branches of the inflorescence. It may be pointed out here that the primary shoot in seedlings is almost invariably angled and winged, and that in a few species the very youngest twigs may be winged, but very soon become terete.

6. Characters of importance in the fruit and seed are the size of the fruit, if it is certain that ripe fruit is being examined, the colour of the ripe fruit, the shape and size of the apical umbilicus, and the extent of the remains of the calyx tube, and the presence or absence of calyx lobes. The shape of the fruit is usually more or less globose, depressed globose or pyriform or turbinate. In the clavate flowered group it may be spindle shaped or oblong, but when

a fleshy or pulpy pericarp is present, the shape alters considerably on drying. Seed characters are not very reliable in dried material, but the presence or absence of a long conspicuous hypocotyle and the peculiar structure in such species as *E. claviflora* and *E. Cumingiana*, already referred to, are diagnostic. Gagnepain stresses the importance of the position of the cotyledons in the seed, whether juxtaposed or superposed, but I have not found that this character is a reliable one.

7. Bracts and bracteoles appear to be present in all species, but in most they are very fugacious. In some few species they are persistent and quite conspicuous.

8. The great majority of species are glabrous in all their parts, but one or two are tomentose on the leaves and inflorescence.

In the field there are other characters which may be of considerable value, the most important being bark characters, which are reasonably constant for each species provided that adult, or at least not sapling, trees are examined. Saplings may have very different bark from mature trees, and colour and even texture may be altered by exposure to full sunlight. A short description of the bark of the living tree has been given for each species for which such information has been collected. The terms used in these descriptions are those evolved by Mr. E. J. H. Corner and are as follows:—

*Entire*: never creviced, cracked, flaky or fissured, but may be pimply or bumpy.

*Smooth*: may be finely creviced but not flaky, bumpy or pustular.

*Creviced*: smooth bark cracked into fine, generally longitudinal lines just large enough to admit the edge of a knife blade and no more.

*Fissured*: bark split into longitudinal gaping furrows.

*Rugose-fissured*: bark fissured with rugged ridges between the furrows.

*Flaky* or *Scaly*: bark scaling or breaking off in pieces.

*Fibrous-flaky*: bark rather fissured but intervals between fissures break up into rather long narrow fibres and scaly pieces.

*Dimpled-flaky*: bark scaling in small rounded thin pieces leaving small patches of clean new bark.

*Papery-flaky*: flakes consisting of pieces like tissue paper tightly pressed together.

*Peeling bark*: coming off in scroll-like pieces leaving clean sheets of new bark.

*Pustular bark*: pimply or bumpy with small lenticels.

There is the usual difficulty in describing the colours of the bark, but the terms used are as simple as possible and no attempt is made to define very exactly shades of colour, which in any case vary slightly from tree to tree of the same species.

Many species have a smooth or finely creviced bark which is whitey-grey, pinkish-grey or pinkish-brown to red. Other distinctive barks are the reddish or brown fissured and often scaly barks, and the orange-red papery-flaky barks. The majority of species seem to have thin barks which strip easily from the wood, but some have a comparatively thick and often dark red or purplish inner bark and some have hard and very fibrous inner bark.

The loan of herbarium material from the following institutions is gratefully acknowledged: Botanic Gardens, Buitenzorg, Java; Royal Botanic Gardens, Calcutta; Forest Research Institute, Dehra Dun; Bureau of Science, Manila; Rijks Herbarium, Leiden; Forest Research Institute, Kepong, Malaya. I have also to thank the authorities at Kew for permission to work in the Herbarium there at various times and for photographs of certain species, and the Director of the Natural History Museum, Paris, for photographs of Lamarckian types. I am deeply indebted to Dr. E. D. Merrill for his helpful comments and advice and for copies of his papers on the Bornean, Chinese and Indo-Chinese *Eugenias*; to Mr. E. J. H. Corner for helpful criticism and detailed field notes on many species; and to Dr. C. X. Furtado for much help with problems of nomenclature. In addition, the gift of seed of various species from the Sydney Botanic Gardens, the Royal Botanic Gardens, Calcutta, and the United States Department of Agriculture is acknowledged with thanks.

The following abbreviations of the titles of works which may not be familiar to some readers have been used throughout:

"Mat. F.M.P."—Materials for a Flora of the Malayan Peninsula, by Sir George King. This appeared originally in the Journal of the Asiatic Society of Bengal and the part dealing with the Myrtaceae appeared in Vol. LXX, part ii, No. 1 of that Journal, in 1901.

"F.M.P."—Flora of the Malay Peninsula, by H. N. Ridley.

- "Journ. Roy. As. Soc. Str. Br."—Journal of the Straits Branch Royal Asiatic Society, later the Malayan Branch.
- "Journ. F.M.S. Mus."—Journal of the Federated Malay States Museums.
- "S.F.N." is used throughout to signify Singapore Field Number, a single series of numbers used by all collectors from the Botanic Gardens, Singapore.

### EUGENIA Linn.

*Trees* or *shrubs*, glabrous, or rarely tomentose or villous. *Leaves* opposite, exstipulate, usually glandular, penninerved, usually with an intramarginal vein. *Flowers* solitary in the leaf axils, or in heads, or in few flowered or many flowered cymes, panicles or racemes, usually terminal and axillary, sometimes from the leafless branches; bracts and bracteoles usually inconspicuous and fugacious, occasionally conspicuous and persistent; *calyx tube* from globose to narrowly elongate turbinate, not at all, or much produced above ovary, the base often contracted into a pseudostalk, lobes 4 or 5, large and prominent or inconspicuous or none, persistent or caducous, very rarely the calyx limb calyptrate or the upper part of the tube splitting irregularly after anthesis; *petals* usually 4 or 5, free and spreading or more or less connivent or agglutinated and calyptrate; *stamens* usually numerous in several series on the margin of the disc lining the calyx tube, free or very obscurely collected into 4 bundles, or very rarely on the surface of the calyx tube above the disc, anthers versatile, small, the cells parallel or rarely divaricate, opening longitudinally or very rarely by apical slits, connective gland usually present; *ovary* 2-celled, rarely 3- or 4-celled, with few to several ovules in each cell; *style* short or long, usually filiform, stigma punctiform, rarely capitate.

*Fruit* a berry, but with few (1-2, rarely more) seeds, the rind pulpy or leathery or dry and pithy, the apex usually crowned by the persistent remains of the calyx tube, or the persistent and often enlarged calyx lobes, or both; seeds usually large, the testa membranous, fibrous, cartilaginous, or crustaceous, the cotyledons fleshy, either completely free or partially or wholly fused together.

A genus of about 1,000 species, distributed throughout the tropics.

The following are the most important synonyms for this region: *Syzygium* Gaertn., Fruct. I, 166, t. 33 (1788); *Jambosa* DC., Prodr., III, 286 (1823); *Caryophyllus* Linn.,

Sp. Pl. ed. 5, 232 (1754); *Calyptanthus* Bl., Bijdr., 1089 (1826); *Clavimyrthus* Bl., Mus. Bot. Lugd.-Bat., I, 113 (1849); *Microjambosa* Bl., Mus. Bot. Lugd.-Bat., I, 117 (1849); *Strongylocalyx* Bl., Mus. Bot. Lugd.-Bat., I, 89 (1849); *Macromyrtus* Miq., Fl. Ind. Bat. I, i, 439 (1855); *Cleistocalyx* Bl., Mus. Bot. Lugd.-Bat., I, 84 (1849); *Acmena* DC., Prodr., III, 262 (1828).

## KEY TO SECTIONS OF EUGENIA IN MALAYA

1. Stamens on margin of disc lining calyx tube, calyx tube not splitting longitudinally after anthesis 2. Stamens on inside of calyx tube above disc, calyx tube splitting longitudinally after anthesis  
§ *Fissicalyx*.
2. Anther cells not divaricate, usually elongate, opening by longitudinal slits . . . . . 3.  
 Anther cells globose, divaricate, opening by terminal slits . . . . . § *Acmena*.
3. Calyx calyptrate, not lobed, the upper part falling as a lid . . . . . § *Cleistocalyx*.  
 Calyx not calyptrate; if lobed, the lobes free  
§ *Syzygium*.

## § SYZYGIUM, KEY TO GROUPS

1. Calyx tube including pseudostalk at least 1 cm. long . . . . . 2.  
 Calyx tube including pseudostalk less than 1 cm. long . . . . . 4.
2. Calyx tube campanulate, broadly obconic, broadly funnel shaped or subglobose . . . . . 3.  
 Calyx tube fusiform or gradually narrowed from apex to base, or clavate or pegshaped  
Group 5.
3. Inflorescences very short, flowers usually few, usually fascicled or in short cymes  
Group 1.  
 Inflorescences usually spreading and many flowered, racemiform or paniced, not very short, or fascicled, or of contracted cymes  
Group 2.
4. Calyx tube campanulate, urceolate, obconic or broadly funnel shaped . . . . . Group 3.  
 Calyx tube narrowly funnel shaped, tapering evenly from apex to base . . . . . Group 4.

# KEY TO MALAYAN SPECIES OF EUGENIA § SYZYGIUM

## GROUP 1

Flowers large, calyx tube including pseudostalk 1 cm. or more long, more or less campanulate, broadly obconic or broadly funnel-shaped or subglobose, not clavate, fusiform, narrowly funnel-shaped or peg shaped, lobes usually conspicuous and often persistent, inflorescences very short, usually fascicled or in short cymes, not spreading, paniced or racemiform, usually few flowered.

1. Inflorescences on branches below leaves .. 2.  
    Inflorescences terminal or axillary .. 4.
2. Leaf bases narrowed on to petiole  
    (1) *malaccensis*.  
    Leaf bases cordate or rounded, not narrowed to  
    petiole .. .. 3.
3. Leaves tapering gradually from base to apex,  
    broadest near base .. (2) *tekuensis*.  
    Leaves broadest about middle, tapering to each  
    end .. .. (4) *perakensis*.
4. Leaf bases cordate or rounded, not tapering on to  
    petiole .. .. 5.  
    Leaf bases narrowed on to petiole .. 14.
5. Calyx tube globose-turbinate, suddenly contracted  
    into a rather long slender pseudostalk  
    (5) *aquea*.  
    Calyx tube not globose-turbinate, narrowed  
    gradually to base, not suddenly contracted 6.
6. Inflorescence branchlets and peduncle exceedingly  
    stout, nerves below slender and not elevate, leaf  
    base auricled .. .. (6) *auriculata*.  
    Inflorescence branchlets slender .. 7.
7. Vegetative branchlets strongly angled or winged 8.  
    Vegetative branchlets terete or at most slightly  
    compressed .. .. 9.
8. Main nerves almost at right angles to midrib, not  
    conspicuous below, leaves oblong (7) *quadrata*.  
    Main nerves leaving midrib at less than a right  
    angle, conspicuous below, leaves ovate to elliptic  
    (15) *Scortechinii*.
9. Leaves very large, c. 30 cm. or more long and c.  
    20 cm. broad, deeply cordate, main nerves  
    very prominent below, 20-30 pairs, 2-2.5 cm.  
    apart .. .. (8) *scalarinervis*.

- Leaves not as above, not so broad, not deeply cordate, main nerves not exceeding 15 pairs, less prominent . . . . . 10.
10. Leaves oblong lanceolate, often long acuminate, broadest near base, main nerves slender but elevate below, running straight to a conspicuous and elevate intramarginal nerve . . . 11.  
 Leaves elliptic, oblong or lanceolate, broadest near middle, main nerves usually not strongly elevate below, or if they are, then curving to intramarginal . . . . . 12.
11. Leaves not exceeding 15 cm. long and 5 cm. broad, drying blackish; calyx tube 1-1.25 cm. long  
 (9) *porphyranthera*.  
 Leaves usually over 15 cm. long, drying brownish or yellowish; calyx tube 1.5 cm. or more long  
 (16) *diospyrifolia*.
12. Inflorescence sessile, flowers sessile  
 (17) *pseudoformosa*.  
 Inflorescence peduncled, flowers pedicelled . . . 13.
13. Calyx tube broadly campanulate, often somewhat swollen at base . . . (16) *diospyrifolia*.  
 Calyx tube broadly funnel-shaped, narrowed gradually to base, not swollen (10) *siamensis*.
14. Leaves thick, not exceeding c. 5 cm. long, elliptic to obovate, apex rounded, mountain shrub  
 (11) *oreophila*.  
 Leaves thin, more than 5 cm. long, not obovate, apex acute to acuminate, lowland trees . . . 15.
15. Leaves narrow lanceolate, long narrowed to both ends, long acuminate . . . . . 16.  
 Leaves usually elliptic to ovate, not long acuminate . . . . . 19.
16. Pedicels usually 1 cm. or more long, cultivated tree  
 (12) *Jambos*.  
 Pedicels not exceeding 5 mm., or flowers sessile, not cultivated . . . . . 17.
17. Calyx tube rounded at base, leaves lead colour on both surfaces when dry . . . (13) *plumbæa*.  
 Calyx tube narrowed gradually to base, leaves drying paler below than above . . . . . 18.
18. Leaves drying blackish above, brownish white or greyish white below, up to 16 × 4.5 cm., pedicels c. 4-5 mm. . . . . (14) *Rostadonis*.  
 Leaves drying brown above, pale brown below, flowers usually nearly sessile (18) *tiomanensis*.

19. Flowers pedicellate, pedicels 6–10 mm. long  
(19) *pendens*.  
Flowers sessile or pedicel less than 5 mm. long 20.
20. Calyx very abruptly contracted into a pseudostalk  
8–10 mm. long, leaves oblong elliptic, abruptly  
narrowed at apex and base (20) *johorensis*.  
Calyx gradually narrowed into a pseudostalk 3–4  
mm. long, leaves ovate to lanceolate, rather long  
narrowed at base  
(15) *Scortechinii* var. *cuneata*.

## GROUP 2

Flowers generally smaller than in Group 1, but calyx including pseudostalk at least 1 cm. long, campanulate, obconic or funnel shaped, not clavate, fusiform, narrowly funnelshaped or pegshaped. Inflorescences terminal and axillary, usually spreading and many flowered, racemiform or paniced, not very short, or fascicled, or in contracted cymes.

1. Leaves cordate or rounded at base, not narrowed on to petiole . . . . . 2.  
Leaves narrowed on to petiole, not cordate or rounded . . . . . 6.
2. Lower surface of leaves, inflorescence and calyx tube softly pubescent . . (22) *pseudomollis*.  
All parts glabrous . . . . . 3.
3. Flowers densely crowded at ends of inflorescence branchlets, subtended by conspicuous persistent bracts and bracteoles almost as long as calyx tube; leaves cordate amplexicaul

(23) *papillosa*.

Flowers densely crowded or not, bracts and bracteoles, if present, fugacious and inconspicuous; leaves shortly rounded at base . . . . . 4.

4. Calyx tube more or less globose above and suddenly contracted into a slender pseudostalk, fruit turbinate; cultivated . . . . . (5) *aquea*.

Calyx tube funnel shaped or campanulate and narrowed gradually to a short pseudostalk, fruit globose or pyriform . . . . . 5.

5. Flowers in a dense inflorescence, sessile or shortly pedicelled, nerves and reticulations raised above and conspicuous; wild tree of inland forest

(24) *densiflora*.

Flowers in a lax inflorescence, usually long pedicelled, nerves and reticulations not raised and conspicuous above; cultivated, or wild near sandy seacoasts . . . . . (21) *javanica*.

6. Nervation of leaves (except midrib) very obscure or practically invisible on both sides, or where visible, the primaries close together and not distinguishable from secondaries, leaves rhomboid, c.  $4 \times 1.25$  cm. (25) *rhomboidea*.  
Nervation quite visible, at least on lower surface, primaries usually spaced, leaves not rhomboid, usually much more than 4 cm. long .. 7.
7. Leaves linear lanceolate, 6–10 times as long as broad, not exceeding c. 2 cm. broad (26) *salictoides*.  
Leaves always broader in proportion to length, not linear lanceolate, always exceeding 2 cm. wide 8.
8. Nerves and reticulations well marked and conspicuous on upper surface of leaf and often strongly elevate .. 9.  
Nerves and reticulations usually faint on upper surface, the reticulations at least not raised and conspicuous, often obscure, the primaries usually quite visible but slender .. 12.
9. Leaves rounded at apex or with a very short blunt point, always more or less obovate (27) *garcinifolia*.  
Leaves acute or acuminate at apex, never obovate 10.
10. Leaves narrowly oblong elliptic or oblong lanceolate, with 2 well marked intramarginal nerves, the inner c. 1 cm. from leaf margin, calyx lobes 4–5 mm. tall .. (24) *densiflora*.  
Leaves not oblong, intramarginal nerve 1, or if 2, the inner much less than 1 cm. from margin, calyx lobes less than 4 mm. tall .. 11.
11. Inflorescence c. 6 cm. long with very stout branchlets, almost as stout as vegetative branchlets, leaves c. 5 cm. broad with abrupt deflexed point; mountain plant .. (28) *selangorensis*.  
Inflorescence much longer, with slender branchlets, leaf 8 cm. or more broad, apex not abruptly deflexed; seashore or cultivated (30) *grandis*.
12. Leaves more or less obovate or oblanceolate, tapering from above middle to petiole, branchlets white or yellow, calyx tube not contracted into a pseudostalk .. (31) *pachyphylla*.  
Leaves never obovate or oblanceolate, branchlets reddish or brownish, calyx tube contracted into a distinct, even if very short, pseudostalk 13.

13. Inflorescence short, 5-6 cm. long with few flowers  
14.  
Inflorescence longer and densely flowered, or if not  
longer than c. 6 cm., with 30-50 or more flowers  
15.
14. Leaves not exceeding c. 20 cm. long, drying greenish  
or pale brown below, inflorescence branches  
slender .. (19) *pendens*.  
Leaves exceeding 25 cm. long, drying red brown  
below, inflorescence branches, short, stout  
(32) *atronervia*.
15. Calyx tube tapering gradually to a very short  
pseudostalk, leaves narrowly oblong elliptic or  
oblong lanceolate .. (24) *densiflora*.  
Calyx tube rather suddenly contracted into a short  
rather slender pseudostalk, leaves elliptic or  
ovate .. (29) *palembanica*.

## GROUP 3

Flowers small, calyx tube including pseudostalk less than 1 cm. long, usually less than 6 mm. long, campanulate, urceolate, obconic or broadly funnel shaped, not tubular, peg shaped, fusiform or narrowly funnel shaped, mouth lobed or not, but lobes not spreading, not conspicuous, fugacious or persistent, inflorescences usually terminal or axillary, rarely on branches below leaves, usually many flowered.

1. Mouth of calyx tube in mature bud cut into 4 or 5  
distinct lobes, the lobes broad, rounded,  
triangular, blunt or acute .. 2.  
Mouth of calyx tube in mature bud not distinctly  
lobed, but truncate, or wavy or with very shallow  
broad obscure lobes, or the lobes reduced to  
small points .. 149.
2. Leaf bases rounded or cordate, not narrowed on to  
petiole .. 3.  
Leaf bases narrowed on to petiole .. 14.
3. Primary nerves spaced, c. 1 cm. distant and  
distinct, at least below, even if slender, more  
prominent than secondaries, intramarginal nerve  
usually distinct .. 4.  
Primary nerves close together and not more  
prominent than secondaries, or very obscure or  
invisible, intramarginal nerve usually obscure or  
very close to margin .. 10.
4. Under surface of leaves, twigs, inflorescences and  
calyx softly pubescent .. (22) *pseudomollis*.  
All parts glabrous .. 5.

5. Flowers in dense heads at ends of inflorescence branchlets, bracts and bracteoles conspicuous and persistent, almost as long as calyx tube, leaves amplexicaul . . . (23) *papillosa*.  
Flowers not in dense heads, bracts and bracteoles very small or fugacious, leaves not amplexicaul 6.
6. Leaves large, 25 cm. or more long, narrow oblong, with 25 or more pairs of primary nerves (60) *pergamentacea*.  
Leaves much smaller and shorter, with fewer pairs of primary nerves . . . 7.
7. Inflorescence from twigs below leaves and shorter than leaves, with very few distant flowers (34) *kemamanensis*.  
Inflorescence terminal or from upper axils, usually as long as or longer than leaves . . . 8.
8. Flowers not densely crowded, inflorescence branchlets slender . . . (35) *cordifoliata*.  
Flowers crowded (but not in heads), ultimate branchlets of inflorescence short, rather stout 9.
9. Leaves drying greenish, edge strongly revolute, apex retuse or rounded, nerves and reticulations raised and rather conspicuous above (37) *viridescens*.  
Leaves drying dark brown, edge slightly revolute, apex bluntly acute, upper surface polished or smooth, nerves and reticulations obscure or invisible . . . (36) *subdecussata*.
10. Calyx club shaped, c. 8-9 mm. long, long narrowed to base . . . (124) *spissifolia*.  
Calyx much shorter, not club shaped and long narrowed to base . . . 11.
11. Leaves with close raised conspicuous reticulation below, rarely exceeding c. 5 cm. long (38) *Wrayi*.  
Leaves rarely less than c. 6 cm. long, nerves and reticulations not raised and conspicuous below 12.
12. Leaf bases usually subcordate, leaves smooth above, nerves not elevate above . . . (36) *subdecussata*.  
Leaf bases never subcordate, nerves and reticulations more or less raised above . . . 13.
13. Leaves drying brownish, broadest near base, usually more or less acute, calyx lobes triangular subacute . . . (40) *pahangensis*.  
Leaves drying greenish, usually rounded or retuse at apex, more or less obovate, calyx lobes rounded . . . (37) *viridescens*.

14. Primary nerves spaced, more prominent, at least below, than secondaries and easily distinguished from them .. .. 15.  
Primary nerves numerous, close together, hardly or not distinguishable from secondaries, or very obscure, or invisible .. .. 101.
15. Inflorescences from branches below leaves or from axils of fallen leaves .. .. 16.  
Inflorescences terminal or from upper axils .. 19.
16. Calyx tube urceolate, without pseudostalk  
(104) *conglomerata*.  
Calyx tube campanulate or obconic, with or without pseudostalk .. .. 17.
17. Calyx after anthesis opening out into a flat disc, pseudostalk slender, inflorescence few flowered, leaves usually c. 15 cm. or more long with c. 15 pairs of primary nerves (105) *leptostemon*.  
Calyx not opening into a flat disc, pseudostalk very short or none, leaves rarely exceeding 10-12 cm. long with rarely more than 12 pairs of primary nerves .. .. 18.
18. Twigs with very pale, almost white bark, calyx obconic, not narrowed into a pseudostalk  
(106) *pseudosubtilis*.  
Twigs with reddish or brownish bark, calyx campanulate, narrowed into a short pseudostalk  
(110) *polyantha*.
19. Primary nerves not more than 15 pairs .. 20.  
Primary nerves more than 15 pairs .. 80.
20. Flowers on filiform pedicels 10 mm. or more long, inflorescence laxly few flowered  
(71) *filiformis*.  
Flowers pedicelled or not, but pedicels not filiform and always much less than 10 mm. long, flowers usually crowded .. .. 21.
21. Bracts conspicuous, as long as, or almost as long as calyx .. .. 22.  
Bracts small and not conspicuous, if persistent, much shorter than calyx .. .. 23.
22. Inflorescences very short and dense, not exceeding 2-3 cm. long, bracts persistent (42) *Hoseana*.  
Inflorescences 5 cm. or more long, bracts not persistent .. .. (31) *pachyphylla*.
23. Calyx broadly funnel shaped (more or less cylindric with spreading limb), not narrowed into a pseudostalk, often strongly ribbed or angled 24.

- Calyx not as above, usually narrowed into a pseudostalk, tube obconic or very small, rarely strongly angled or ribbed .. .. 26.
24. Young twigs angled, with raised lines, calyx, twigs and leaves pustulate .. (43) *variolosa*.  
Young twigs terete, without raised lines, calyx, twigs and leaves not pustulate .. 25.
25. Branchlets with pale polished bark, leaves more or less obovate or oblanceolate (31) *pachyphylla*.  
Branchlets with dark, not polished bark, leaves more or less elliptic or oblong (44) *chlorantha*.
26. Calyx in mature bud more or less obconic, not exceeding c. 5 mm. long, not contracted at base into a pseudostalk .. .. 27.  
Calyx usually campanulate, always more or less contracted into a pseudostalk, short or long, stout or slender; or if without pseudostalk, then more than 6 mm. long .. .. 32.
27. Bracts and bracteoles persistent or subpersistent, about one third as long as calyx .. 28.  
Bracts and bracteoles fugacious and minute 29.
28. Leaves drying greenish, fruit ellipsoid, rugulose (97) *chloroleuca*.  
Leaves drying brownish, fruit ovoid or obovoid, not rugulose .. .. (45) *Ngadimani*.
29. Leaves oblong lanceolate acuminate, inflorescence branches minutely pustulate (96) *pustulata*.  
Leaves not oblong lanceolate, inflorescence branches not pustulate .. .. 30.
30. Twigs with very pale bark (106) *pseudosubtilis*.  
Twigs with brown or blackish bark .. 31.
31. Leaves obovate, rounded at apex or shortly acute; shrub of open mountain tops (41) *tahanensis*.  
Leaves more or less elliptic, acuminate; tree of lowland forest .. (45) *Ngadimani*.
32. Leaves small, not more than c. 3 cm. wide .. 33.  
Leaves larger, always 4 cm. or more wide .. 43.
33. Apex of leaf blunt or shortly acute, never acuminate 34.  
Apex of leaf always more or less acuminate .. 38.
34. Bark of inflorescence branchlets rough and scaling in small flakes, leaves usually drying greenish (46) *Helferi*.  
Bark of inflorescence branchlets smooth or striate, not flaky, leaves not drying greenish .. 35.

35. Inflorescence much shorter than leaves, 1-2 cm. long, bark of twigs pale . . . (113) *alyxifolia*.  
 Inflorescence as long as or longer than leaves, bark of twigs reddish or black . . . 36.
36. Leaves not more than c. 5 cm. long, reticulations almost invisible above, bark of twigs black; mountain tree . . . (112) *orites*.  
 Leaves rarely less than 6 cm. long, reticulations usually raised and conspicuous above, bark of twigs reddish; lowland or seacoast trees 37.
37. Leaves glaucous below . . . (48) *glauca*.  
 Leaves not glaucous below (48) *glauca* var. *pseudoglauca*.
38. Bark of inflorescence branchlets rough and scaling in small flakes, leaves usually drying greenish (46) *Helpferi*.  
 Bark of inflorescence branchlets smooth or striate, leaves not drying greenish . . . 39.
39. Calyx with unequal lobes, 2 larger than others and subpetaloid . . . (49) *anisosepala*.  
 Calyx lobes equal or subequal, none subpetaloid 40.
40. Nerves and reticulations raised and conspicuous on upper surface of leaf . . . 41.  
 Reticulations not raised and conspicuous above, primary nerves slightly raised or sunk . . . 42.
41. Calyx tube abruptly contracted above ovary; cotyledons fused; tall tree . . . (126) *flosculifera*.  
 Calyx tube not so contracted; cotyledons free; small trees . . . 43.
42. Inflorescences usually below leaves, never terminal, leaves drying brown, primary nerves slightly raised above . . . (110) *polyantha*.  
 Inflorescences terminal, leaves drying black, primary nerves slightly sunk above (111) *Koordersiana*.
43. Calyx lobes unequal, 2 larger than others and subpetaloid . . . (49) *anisosepala*.  
 Calyx lobes subequal, none subpetaloid . . . 44.
44. Inflorescence branchlets with rough bark scaling in small flakes . . . (46) *Helpferi*.  
 Inflorescence branchlets smooth or striate, not flaky . . . 45.
45. Bracts and bracteoles persistent, c. one-third length of calyx, fruit ellipsoid, drying pale and rugulose (97) *chloroleuca*.  
 Bracts and bracteoles minute or fugacious, fruit more or less globose, not drying pale or rugulose 46.

46. Inflorescences from below leaves, never terminal or from upper axils .. .. 47.  
 Inflorescences terminal or from upper few axils .. .. 48.
47. Leaves usually 15 cm. or more long, with 15 pairs of primary nerves, calyx after anthesis opening out into a flat disc, inflorescences few flowered  
 (105) *leptostemon*.  
 Leaves rarely exceeding 10–12 cm. long, primary nerves rarely more than 12 pairs, calyx not opening into a flat disc, inflorescence many flowered .. .. (110) *polyantha*.
48. Nerves and reticulations raised on upper surface of leaf and conspicuous .. .. 49.  
 Secondary nerves and reticulations not raised on upper surface, inconspicuous or invisible, primary nerves usually slender, often sunk 58.
49. Apex of leaf acuminate .. .. 50.  
 Apex of leaf rounded, obtuse, shortly bluntly acute, or with an abrupt short point .. .. 53.
50. Inflorescence branches very stout, apex of leaf abruptly deflexed; mountain plant  
 (28) *selangorensis*.  
 Inflorescence branches slender, apex of leaf not deflexed; lowland plants .. .. 51.
51. Pseudostalk slender, distinct, about half the length of the calyx tube  
 (48) *glauca* var. *pseudoglauca*.  
 Pseudostalk short and stout .. .. 52.
52. Calyx lobes more or less orbicular, c. 1–2 mm. tall  
 (66) *Haniffii*.  
 Calyx lobes broad and shallow, less than 1 mm. tall  
 (70) *Brantiana*.
53. Leaves sessile, or petioles not more than 2–3 mm. long; mountain plant .. (37) *viridescens*.  
 Leaves not sessile, petioles usually exceeding 5 mm. long; lowland plants .. .. 54.
54. Leaves glaucous below .. (48) *glauca*.  
 Leaves not glaucous below .. .. 55.
55. Calyx ribbed, rather abruptly contracted into a short stout pseudostalk .. (29) *palembanica*.  
 Calyx not ribbed, narrowed gradually into pseudostalk .. .. 56.
56. Primary branches of inflorescence very stout, as stout as twigs, flowers densely crowded, petals usually calyptrate .. (50) *Kiahii*.  
 Primary branches of inflorescence slender, thinner than twigs .. .. 57.

57. Calyx lobes distant, petals usually calyptrate,  
flowers densely crowded  
(50) *Kiahii* var. *angustifolia*.  
Calyx lobes approximate, petals free, flowers not  
densely crowded  
(51) *Burkilliana* var. *garcinifolioides*.
58. Inflorescences racemose, not paniced .. 59.  
Inflorescences paniculate .. .. 62.
59. Calyx after anthesis opening out into a flat disc,  
pseudostalk slender .. (105) *leptostemon*.  
Calyx not opening into a flat disc, pseudostalk stout  
60.
60. Inflorescence very short, almost sessile, not exceed-  
ing c. 2 cm. long, leaves thin, conspicuously  
gland dotted .. .. (43) *variolosa*.  
Inflorescences usually several in each axil,  
peduncled, c. 5 cm. long or longer .. 61.
61. Pseudostalk less than half length of calyx  
(52) *Duthieana*.  
Pseudostalk about half length of calyx  
(53) *Griffithii*.
62. Secondary branchlets of inflorescence very short,  
usually under 1 cm. long, and as stout as twigs,  
leaves more or less orbicular .. (50) *Kiahii*.  
Secondary branchlets of inflorescence over 1 cm.  
long, usually slender, spreading, or if not more  
than 1 cm. long, much more slender than twigs,  
leaves not orbicular .. .. 63.
63. Flowers densely crowded, secondary branchlets of  
inflorescence slender, not exceeding c. 1 cm. long  
64.  
Secondary branchlets of inflorescence 2 cm. or more  
long, flowers not densely crowded except some-  
times at ends of branchlets .. .. 65.
64. Primary nerves usually 4-5 pairs, curving sharply  
up to intramarginal, young twigs whitey-brown  
(33) *Millsii*.  
Primary nerves more than 6 pairs, running nearly  
straight to intramarginal, young twigs reddish  
brown .. .. (66) *Haniffii*.
65. Inflorescences short and fewflowered, often from  
lower axils, calyx after anthesis opening out into  
a flat disc .. .. (105) *leptostemon*.  
Inflorescences terminal or from upper axils, many  
flowered, calyx not opening into a flat disc 66.

66. Calyx suddenly contracted or narrowed into a well marked rather slender pseudostalk about half length of calyx tube .. 67.  
Calyx with very short stout pseudostalk less than half length of tube .. 75.
67. Twigs somewhat angled and with definite raised lines between nodes  
(54) *Thumra* var. *penangiana*.  
Twigs terete without raised lines .. 68.
68. Calyx in mature bud c. 8 mm. long, 5 mm. across mouth, longitudinally ribbed (29) *palembanica*.  
Calyx shorter and not so wide, not ribbed .. 69.
69. Primary nerves and intramarginal noticeably sunk above .. 70.  
Primary nerves and intramarginal not noticeably sunk above .. 71.
70. Bark of twigs whitish, calyx c. 4 mm. long  
(55) *Swettenhamiana*.  
Bark of twigs reddish or red brown, calyx 6-7 mm. long .. (53) *Griffithii*.
71. Intramarginal nerve 1-3 mm. from leaf margin, not more .. 72.  
Intramarginal nerve at least 4 mm. from margin, usually more .. 74.
72. Primary nerves leaving midrib almost at a right angle, twigs with almost black, very smooth bark .. (56) *subhorizontalis*.  
Primary nerves leaving midrib at an angle of 50-60 degrees, bark of twigs reddish, often rather flaky .. 73.
73. Leaves glaucous below, usually under 10 cm. long  
(48) *glauca*.  
Leaves not glaucous below, usually over 10 cm. long  
(53) *Griffithii*.
74. Calyx lobes rather spreading in bud, not closely adpressed over petals, flowers green, young leaves blue .. (57) *Ridleyi*.  
Calyx lobes not spreading in bud, closely adpressed over petals, flowers white, young leaves purple  
(53) *Griffithii*.
75. Primary nerves rarely more than 4-5 pairs, twigs with greyish white bark, often somewhat angled and with raised lines between the nodes  
(33) *Millsii*.  
Primary nerves always more than 6 pairs, twigs with blackish, reddish or brownish bark, terete, without raised lines .. 76.

76. Calyx in mature bud c. 8 mm. long and 5 mm. wide, ribbed .. .. (29) *palembanica*.  
Calyx shorter and narrower, not ribbed .. 77.
77. Leaves rarely more than c. 10 cm. long, primary nerves not more than c. 12 pairs, usually less, inflorescence usually longer than leaves .. 78.  
Leaves rarely less than c. 15 cm. long, with 12-15 pairs of primary nerves, inflorescences not longer than leaves .. .. 79.
78. Calyx lobes more or less orbicular and overlapping in bud .. .. (111) *Koordersiana*.  
Calyx lobes broad and shallow, not overlapping in bud .. .. (70) *Brantiana*.
79. Leaves rarely more than c. 23 cm. long, inflorescences from half as long to as long as leaves (58) *Dyeriana*.  
Leaves usually over 25 cm. long, inflorescences rarely reaching half their length (59) *Hemsleyana*.
80. Flowers on long filiform pedicels 10 mm. or more long, inflorescence laxly few flowered (71) *filiformis*.  
Flowers sessile or pedicelled, pedicels much less than 10 mm. long .. .. 81.
81. Calyx narrowed or contracted suddenly at base into a well marked, short or long, stout or slender pseudostalk .. .. 82.  
Calyx without definite pseudostalk .. 97.
82. Inflorescence branches with rough bark scaling in small flakes .. .. (46) *Helferi*.  
Inflorescence branches smooth or striate, not flaky 83.
83. Inflorescences less than half length of leaves, usually racemiform, occasionally paniculate 84.  
Inflorescences at least half length of leaves, usually paniculate, occasionally racemiform .. 89.
84. Calyx opening after anthesis into a flat disc, inflorescences usually from lower axils (105) *leptostemon*.  
Calyx not opening into a flat disc, inflorescences terminal or from upper axils .. 85.
85. Calyx, twigs and leaves pustulate (43) *variolosa*.  
Calyx, twigs and leaves not pustulate .. 86.
86. Leaves not exceeding c. 13 cm. long, drying greenish, flowers crowded in a dense inflorescence broader than long .. (66) *Haniffii*.

- Leaves exceeding 16 cm. long, drying blackish, reddish or brownish, flowers not densely crowded, except at ends of inflorescence branchlets, inflorescence longer than broad .. 87.
87. Leaves markedly oblong .. (60) *pergamentacea*.  
Leaves more or less elliptic .. 88.
88. Calyx c. 8-9 mm. long .. (32) *atronervia*.  
Calyx c. 5-6 mm. long .. (59) *Hemsleyana*.
89. Leaves 20-25 cm. long or more .. 90.  
Leaves rarely exceeding 15-17 cm. long .. 91.
90. Leaves oblong .. (60) *pergamentacea*.  
Leaves elliptic .. (59) *Hemsleyana*.
91. Leaves glaucous below, bark of young twigs usually scaly flaky .. (48) *glauca*.  
Leaves not glaucous below, bark of young twigs usually smooth .. 92.
92. Inflorescences nearly sessile or very shortly pedunculate, branching widely from base, petiole c. 5 mm. long .. (61) *Gageana*.  
Inflorescences definitely peduncled, petiole c. 1 cm. long .. 93.
93. Inflorescence of clustered racemes (53) *Griffithii*.  
Inflorescences paniculate .. 94.
94. Inflorescence lax with sparse slender branchlets 95.  
Inflorescence dense with crowded branchlets 96.
95. Twigs with nearly black bark, nerves and reticulations slightly raised on upper surface (56) *subhorizontalis*.  
Twigs with red or brown bark, secondary nerves and reticulations obscure or invisible above, primary nerves often sunk .. (53) *Griffithii*.
96. Inflorescence branches stout, fruit with apical calyx tube c. 5-6 mm. long .. (62) *Prairieana*.  
Inflorescence branches slender, apical calyx tube on fruit none .. (64) *oblata*.
97. Bracts and bracteoles persistent, about one-third as long as calyx tube, fruit ellipsoid, drying pale and rugulose .. (97) *chloroleuca*.  
Bracts and bracteoles fugacious or minute, fruit not ellipsoid, or drying pale and rugulose.. 98.

98. Leaves oblong lanceolate, inflorescence branches and twigs minutely pustulate .. 99.  
 Leaves elliptic to oblong- or ovate-elliptic, inflorescence branches and twigs not pustulate 100.
99. Inflorescence a short panicle, calyx c. 4–5 mm. long, sessile .. (96) *pustulata*.  
 Inflorescence of short racemes, calyx c. 6–8 mm. long, pedicelled .. (43) *variolosa*.
100. Calyx tube cylindric, ribbed, leaves drying greenish or pale brown, not exceeding c. 15 cm. long  
 (44) *chlorantha*.  
 Calyx tube not cylindric or ribbed, leaves drying reddish or blackish brown, usually over 20 cm. long .. (59) *Hemsleyana*.
101. Flowers on filiform pedicels 10 mm. or more long  
 (71) *filiformis*.  
 Flowers sessile, or if pedicelled, pedicels not filiform and much shorter .. 102.
102. Leaves not exceeding 6–7 cm. long, caudate acuminate .. 103.  
 Leaves usually exceeding 10 cm. long, acuminate, acute or blunt, rarely caudate acuminate, or if less than 10 cm. long, not caudate acuminate 115.
103. Inflorescence branchlets with rough bark, scaling in small flakes .. (46) *Helferi*.  
 Inflorescence branchlets with smooth, striate, or scurfy but not flaky bark .. 104.
104. Inflorescence racemose, few flowered (3–6), very much shorter than leaves .. 105.  
 Inflorescences paniculate, many branched, or fascicled, many flowered, usually at least half length of leaves .. 106.
105. Calyx suddenly contracted at base into a short slender pseudostalk .. (72) *caudata*.  
 Calyx gradually narrowed to base (74) *Benjamina*.
106. Inflorescence branches and branchlets square, strongly 4-angled or almost winged .. 107.  
 Inflorescence branches and branchlets terete or more or less compressed and striate, not strongly angled or winged .. 109.
107. Calyx more or less campanulate, not ribbed; nervation usually invisible on upper surface of leaf, not raised and often obscure below (73) *oleina*.  
 Calyx broadly funnel shaped, vertically ribbed or ridged .. 108.

108. Petals with conspicuous glands, fruit smooth without persistent calyx lobes; lowland tree  
(81) *linocieroidea*.  
Petals without glands, fruit ridged, with persistent calyx lobes; mountain tree .. (82) *goniocalyx*.
109. Flower buds narrow, not exceeding c. 2 mm. diam. at widest point .. .. 110.  
Flower buds wider, always 3 mm. or more diam. at widest point .. .. 112.
110. Calyx suddenly contracted into a slender pseudostalk about half length of tube, inflorescence branches smooth .. (75) *syzygioides*.  
Calyx gradually narrowed into a pseudostalk, inflorescence branches scurfy or pustulate 111.
111. Inflorescence branches scurfy, calyx not pustulate (76) *castanea*.  
Inflorescence branches pustulate, calyx tube more or less pustulate .. (77) *pseudosyzygioides*.
112. Calyx more or less campanulate or obconic, not angled or ribbed .. .. 113.  
Calyx broadly funnel shaped, more or less angled or ribbed .. .. 114.
113. Inflorescence branches stout, twigs with pale polished bark .. .. (65) *laevicaulis*.  
Inflorescence branches slender, twigs with brownish, not polished bark .. (78) *praestigiosa*.
114. Leaves rarely more than 2-25 cm. broad, fruit globose without persistent calyx lobes, dark coloured in life, inner bark thick  
(81) *linocieroidea*.  
Leaves usually over 2.5 cm. broad, fruit more or less oblong, with persistent calyx lobes, white in life, inner bark thin .. (79) *longiflora*.
115. Bark of inflorescence branches rough, scaling in small flakes .. .. (46) *Helferi*.  
Bark of inflorescence branches smooth or striate, not flaky .. .. 116.
116. Calyx contracted or narrowed at base into a definite rather slender pseudostalk about half length of tube .. .. 117.  
Pseudostalk very short and stout or none .. 126.
117. Inflorescences in axils of all leaves, very short with few branches, not reaching one quarter length of leaves, leaves narrow lanceolate, 5-6 times as long as broad (47) *Graeme-Andersoniae*.  
Inflorescences at least half as long as leaves, much branched, terminal or from upper axils, leaves broader in proportion to length .. 118.

118. Inflorescence peduncle very stout, almost or quite as stout as twigs, secondary branchlets usually also stout, not exceeding c. 1 cm. long, flowers very densely crowded .. 119.  
 Inflorescence peduncle slender, thinner than twigs, secondary branchlets also slender and often exceeding 1 cm. long .. 121.
119. Leaves oblong orbicular with a very short blunt point .. (50) *Kiahii*.  
 Leaves more or less elliptic, acuminate .. 120.
120. Calyx tube in mature bud over 5 mm. long, fruit oblong with a long apical calyx tube (62) *Prairiana*.  
 Calyx tube less than 5 mm. long, fruit globose without apical calyx tube .. (66) *Haniffii*.
121. Calyx suddenly contracted into a slender pseudostalk .. (75) *syzygioides*.  
 Calyx gradually narrowed to base .. 122.
122. Calyx lobes dropping soon after petals fall, not persisting in fruit .. 123.  
 Calyx lobes persistent, appearing on the apex of at least the young fruit .. 124.
123. Calyx tube slightly swollen near base, leaves more or less oblong elliptic or oblong lanceolate, shortly narrowed to apex and base, length about 2-2½ times breadth .. (80) *tumida*.  
 Calyx tube not swollen near base, leaves lanceolate long narrowed to apex and base, length about 3-4 times breadth .. (67) *camptophylla*.
124. Fruit oblong, almost white when ripe, nerves and reticulations hardly raised on upper surface of leaf .. (79) *longiflora*.  
 Fruit more or less globose, dark coloured, nerves more or less raised above .. 125.
125. Mature flower buds 7-9 mm. long, leaves usually over 12 cm. long, drying reddish or blackish brown above, gently acuminate (64) *oblata*.  
 Mature flower buds 5-6 mm. long, leaves not usually exceeding 10-11 cm. long, drying greenish or pale brown above, rather abruptly acuminate .. (66) *Haniffii*.
126. Bracts and bracteoles persistent, more or less conspicuous, often persisting to fruiting stage, one quarter to one third length of calyx tube .. 127.  
 Bracts and bracteoles very small and not conspicuous, or dropping early and not persistent 129.

127. Inflorescence branchlets very stout, as stout as twigs, flowers in heads at their apices  
(83) *quadribacteata*.  
Inflorescence branches slender, flowers not in heads 128.
128. Inflorescence half as long or as long as leaves, spreading, fruit glandular, leaves drying reddish or brownish .. (98) *fastigiata*.  
Inflorescences not reaching half length of leaves, fruit eglandular, leaves drying greenish or pale brown .. (97) *chloroleuca*.
129. Flowers very small, calyx not exceeding c. 4.5 mm. long and 3-3.5 mm. across mouth .. 130.  
Flowers larger, calyx at least 5 mm. long, usually more, and c. 5 mm. across mouth or more 139.
130. Inflorescence with few branchlets almost or quite as stout as twigs, flowers in dense heads at their apices .. (83) *quadribacteata*.  
Inflorescence many branched, branchlets thinner than twigs, flowers not in dense heads 131.
131. Leaves long acuminate, lanceolate .. 132.  
Leaves not long acuminate, or if so, not lanceolate 133.
132. Twigs with pale bark, leaves drying pale brown with strongly revolute edges, inflorescence branchlets striate or more or less compressed, not sharply 4-angled; tree of mountain forest  
(84) *cyrtophylloides*.  
Twigs with red brown or blackish bark, leaves drying reddish or dark brown, edges not revolute, inflorescence branchlets usually smooth, strongly and sharply 4-angled; tree of lowland forest, usually near mangrove  
(73) *oleina*.
133. Bark of twigs pale, almost white .. 134.  
Bark of twigs reddish, brownish or black .. 135.
134. Petioles usually over 5 mm. long, leaves drying brown to black .. (106) *pseudosubtilis*.  
Petioles under 5 mm. long, usually c. 2 mm. long or none, leaves drying greenish  
(37) *viridescens*.
135. Leaves elliptic or lanceolate, not obovate or oblanceolate .. 136.  
Leaves more or less obovate or oblanceolate, apex rounded or with short abrupt point .. 137.

136. Leaves elliptic, acutely acuminate, usually over 3 cm. wide, inflorescence branches not strongly angled .. .. (70) *Brantiana*.  
 Leaves more or less lanceolate, acute or bluntly acuminate, rarely more than c. 2.5 cm. wide, inflorescence branches strongly angled  
 (73) *oleina*.
137. Leaves almost sessile, or petioles not more than 2-3 mm. long .. .. (37) *viridescens*.  
 Leaves distinctly petioled, petioles usually exceeding c. 5 mm. long .. .. 138.
138. Twigs with black bark, leaves 5-6 cm. broad; shrub .. .. (41) *tahanensis*.  
 Twigs with greyish or brownish bark, leaves rarely more than 3.5-4 cm. broad; tree (85) *cerina*.
139. Leaves narrow oblong lanceolate, inflorescences short, c. 2-2.5 cm. long in axils of all leaves; river bank tree .. (47) *Graeme-Andersoniae*.  
 Leaves not as above, inflorescences terminal or from upper axils; not river bank trees 140.
140. Leaves very long narrowed to base, petiole c. 2 cm. long; cultivated .. .. *aromatica*.  
 Leaves not very long narrowed to base, petiole not exceeding c. 1.5 cm., usually 1 cm. or less; wild 141.
141. Twigs very stout, c. 5 mm. diam. near uppermost pair of leaves, inflorescence peduncle and branchlets almost as stout .. .. 142.  
 Twigs and inflorescence branchlets slender, twigs c. 2-3 mm. diam. near uppermost pair of leaves 143.
142. Reticulations more or less raised and easily visible on upper surface of leaves, bark of twigs dark, leaves 5-6 cm. broad, apex deflexed  
 (28) *selangorensis*.  
 Reticulations invisible above, bark of twigs pale, leaves 3-4 cm. broad, apex not deflexed  
 (65) *laevicaulis*.
143. Leaves small, not exceeding c. 5 cm. long, rhomboid, oblanceolate or obovate .. (25) *rhomboidea*.  
 Leaves longer, usually over 6 cm. long, not rhomboid, oblanceolate or obovate .. 144.
144. Calyx more or less cylindric below, usually strongly ribbed, inflorescence rather lax, the branches strongly angled, almost winged, leaves up to c. 15 × 8 cm. .. .. (44) *chlorantha*.

- Calyx not cylindric below, gradually narrowed to base, not ribbed, at most more or less striate, inflorescence dense, branchlets striate or compressed, leaves not exceeding c.  $12 \times 5$  cm. 145.
145. Twigs with pale yellow or greyish white bark 146.  
Twigs with reddish or brownish bark .. 147.
146. Calyx lobes overlapping in bud, more or less orbicular, c. 3 mm. tall .. (87) *Goodenovii*.  
Calyx lobes not overlapping in bud, triangular, c. 1 mm. tall .. (65) *laevicaulis*.
147. Inflorescence narrow, individual inflorescences with few branches, leaves coriaceous, edge strongly revolute .. (78) *praestigiosa*.  
Inflorescence wide, individual inflorescences much branched, leaves thin, edge slightly revolute 148.
148. Leaves drying greenish or pale brown, usually c. 10 cm. long, fruit globose, c. 1.5 cm. diam. (66) *Haniffii*.  
Leaves drying reddish or blackish brown, less than 10 cm. long, fruit oblong, c. 1 cm. long (79) *longiflora*.
149. Leaves rounded or subcordate at base, not narrowed on to petiole .. 150.  
Leaf bases narrowed on to petiole .. 151.
150. Stems and inflorescence branches covered with reddish bristles, leaves oblong lanceolate cuspidate, up to c. 3 cm. wide .. (89) *setosa*.  
Stems and inflorescence branches glabrous, leaves elliptic blunt, usually more than 4–5 cm. wide (36) *subdecussata*.
151. Base of calyx suddenly contracted or narrowed into a distinct more or less slender pseudostalk one third or more the length of the calyx .. 152.  
Calyx without pseudostalk, or pseudostalk very short and stout and not distinct .. 179.
152. Inflorescence branches with rough scaly or flaky bark .. (88) *Curtisii*.  
Inflorescence branches with smooth or striate bark 153.
153. Primary nerves bold and raised below, much more prominent than secondaries or reticulations 154.  
Primary nerves faint or invisible below, or if raised, not much more prominent than secondaries and reticulations .. 156.

154. Inflorescences not exceeding 2–5 cm. long, bark of young twigs flaky .. (90) *pauper*.  
 Inflorescences 5 cm. or more long, bark of young twigs not flaky .. .. 155.
155. Inflorescence lax, twigs terete, leaves 12–15 cm. long .. .. (91) *Klossii*.  
 Inflorescence dense, twigs with raised lines, or more or less angled and winged, leaves usually 20 cm. or more long .. .. (92) *valdevenosa*.
156. Apex of leaf rounded, blunt, or with short blunt abrupt point .. .. 157.  
 Apex of leaf acute, acuminate, or caudate acuminate .. .. 160.
157. Inflorescence peduncle and branchlets very stout, as thick or almost as thick as twigs, leaves oblong orbicular .. .. (50) *Kiahii*.  
 Inflorescence peduncle and branchlets slender, thinner than twigs, leaves not oblong orbicular .. .. 158.
158. Leaves elliptic to ovate, inflorescence usually below leaves; cultivated .. (93) *Cumini*.  
 Leaves more or less obovate, inflorescences terminal or from upper axils; wild .. .. 159.
159. Nerves and reticulations raised on upper surface of leaf, lower surface drying reddish brown, inflorescence dense .. (95) *Muelleri*.  
 Nerves and reticulations almost invisible above, not raised, lower surface drying pallid brown, inflorescence lax .. .. (99) *pallidula*.
160. Flowers very small, mature bud c. 2–3 mm. long, calyx rather abruptly contracted just below mouth .. .. (125) *leucoxylon*.  
 Flowers larger, mature buds at least 4 mm. long and usually longer, calyx not so contracted .. .. 161.
161. Primary and secondary nerves and often reticulations raised and easily visible on upper surface of leaf .. .. 162.  
 Nerves, at least secondaries and reticulations, obscure or invisible on upper surface of leaf .. .. 170.
162. Mature flower buds 9–10 mm. long, bark of older twigs scaly flaky .. (100) *nemestrina*.  
 Mature buds not exceeding c. 7 mm. long, bark of twigs not scaly or flaky .. .. 163.

163. Leaves caudate acuminate, the cusp 1.5–2 cm. long, calyx and inflorescence branches minutely pustulate .. (77) *pseudosyzygioides*.  
 Leaves not caudate acuminate, or if so, cusp 1 cm. or less long, calyx and inflorescence not pustulate .. .. 164.
164. Leaves small, up to c.  $6 \times 3$  cm., abruptly acuminate, petiole c. 5 mm. long .. (101) *taipingensis*.  
 Leaves larger, usually 8 cm. or more long and longer in proportion to width, or if smaller, not abruptly acuminate, petiole usually over 5 mm. long .. .. 165.
165. Reticulation close and raised on upper surface of leaf, as prominent as primary and secondary nerves .. (102) *nigricans*.  
 Reticulation not raised on upper surface, or if so much less prominent than primaries and secondaries .. .. 166.
166. Inflorescences usually below leaves, fruit ovoid oblong; cultivated .. (93) *Cumini*.  
 Inflorescences terminal or from upper axils, fruit more or less globose; wild .. 167.
167. Upper surface of leaf drying paler than lower, pale brown or greenish brown .. (94) *oblongifolia*.  
 Upper surface drying darker than lower, reddish brown or blackish brown .. .. 168.
168. Calyx 3.5–4 mm. across mouth, pseudostalk distinct, rarely more than 2 mm. long (68) *inophylla*.  
 Calyx narrower, c. 2–2.5 mm. across mouth, pseudostalk longer than 2 mm. and well defined, or the calyx gradually narrowed into pseudostalk .. 169.
169. Calyx rather abruptly contracted into a pseudostalk 3–4 mm. long, tube not swollen near base, leaves usually over 10 cm. long (103) *cerasiformis*.  
 Calyx gradually narrowed into pseudostalk, and usually slightly swollen near base, leaves rarely more than 10 cm. long .. (80) *tumida*.
170. Mature flower buds 9–10 mm. long, bark of older twigs scaly flaky .. (100) *nemestrina*.  
 Mature buds not exceeding c. 8 mm. long, usually less, bark of twigs not scaly or flaky .. 171.
171. Leaves abruptly caudate acuminate .. 172.  
 Leaves not abruptly caudate acuminate .. 174.

172. Inflorescence branches filiform, inflorescence lax, flowers distant, calyx c. 4 mm. across mouth  
 (72) *caudata*.  
 Inflorescence branches not filiform, inflorescence many branched, more or less densely flowered, calyx c. 2 mm. across mouth .. 173.
173. Calyx long narrowed into pseudostalk, often slightly swollen near base, not pustulate, cusp of leaf usually c. 1 cm. long .. (80) *tumida*.  
 Calyx more or less abruptly contracted into pseudostalk, minutely pustulate, cusp of leaf usually 1.5-2 cm. long .. (77) *pseudosyzygioides*.
174. Leaves small, usually less than  $8 \times 3.5$  cm., bluntly acute or acuminate, branches of inflorescence paler than twigs, with almost smooth bark and strongly 4-angled, almost winged (73) *oleina*.  
 Leaves usually longer and broader, apex acute, branches of inflorescence not paler than twigs, more or less striate, usually compressed, not strongly 4-angled or winged .. 175.
175. Calyx 3.5-4 mm. across mouth, pseudostalk distinct, rarely more than c. 2 mm. long .. 176.  
 Calyx narrower, c. 2-2.75 mm. across mouth, pseudostalk longer and well defined, or calyx gradually narrowing to pseudostalk .. 177.
176. Bark of twigs drying pale brown to reddish brown, stamens 15-16 mm. long .. (70) *Brantiana*.  
 Bark of twigs drying dark, almost black, stamens not more than c. 10 mm. long (68) *inophylla*.
177. Calyx rather abruptly contracted into a pseudostalk 3-4 mm. long, leaves usually over  $10 \times 5$  cm. .. (103) *cerasiformis*.  
 Calyx gradually narrowed into pseudostalk, leaves usually shorter or narrower: if longer than 10 cm. then not exceeding 4 cm. wide, if wider than 5 cm., not reaching 10 cm. long .. 178.
178. Leaves lanceolate, long acuminate, calyx not swollen near base .. (67) *camptophylla*.  
 Leaves elliptic or oblong elliptic, shortly acuminate, calyx tube often swollen near base  
 (80) *tumida*.
179. Flowers very small, mature buds not exceeding c. 4 mm. long, usually 2.5-3 mm. long 180.  
 Flowers larger, mature buds 5 mm. or more long 190.

180. Inflorescence branches covered with red scurf,  
flower buds more or less globular  
(88) *Curtisii* var. *minor*.  
Inflorescence branches glabrous, buds not globular  
181.
181. Leaves more or less oblanceolate or obovate, apex  
rounded or with a short blunt point .. 182.  
Leaves not oblanceolate or obovate, apex acute or  
acuminate, sometimes very shortly or bluntly so  
185.
182. Primary nerves numerous, faint on lower surface  
and hardly more prominent than secondaries  
and reticulations, bark of twigs flaky  
(85) *cerina*.  
Primary nerves few, spaced, distinct from  
secondaries and reticulations even if faint, bark  
of twigs not flaky .. 183.
183. Leaves small, not more than c. 4 cm. long, primary  
nerves 3-4 pairs .. (108) *myriantha*.  
Leaves larger, usually over 5 cm. long, primary  
nerves more than 4 pairs .. 184.
184. Bark of twigs dark, red or brown, bracteoles  
persistent .. (107) *microcalyx*.  
Bark of twigs almost white, bracteoles not  
persistent .. (106) *pseudosubtilis*.
185. Primary nerves close and numerous, not more  
prominent than secondaries, or very obscure or  
invisible .. 186.  
Primary nerves not more than about 15 pairs,  
usually less, spaced, and more prominent than  
secondaries below, even if faint .. 187.
186. Leaves small, up to  $6 \times 2.5$  cm., nerves almost  
invisible .. (86) *avenis*.  
Leaves large, usually  $10 \times 4$  cm. or more, nervation  
raised and easily visible on both sides  
(69) *Bernardi*.
187. Primary nerves and reticulations strongly raised  
on lower surface of leaf, intramarginal nerve  
2-5 mm. from margin .. (109) *Kunstleri*.  
Primary nerves not or only slightly raised below,  
intramarginal nerve faint or none .. 188.
188. Inflorescence very short and compact, not reaching  
half length of leaves, with very short branchlets,  
leaves with strongly recurved margins, youngest  
twigs 4-angled; mountain shrub  
(113) *alyrifolia*.

- Inflorescence spreading, half as long as leaves or longer, branchlets slender, long, margins of leaves not strongly recurved, youngest twigs terete or compressed; trees, usually lowland 189.
189. Bracteoles persistent, although minute, bark of twigs dark .. .. (107) *microcalyx*.  
Bracteoles not persistent, bark of twigs pale .. .. (106) *pseudosubtilis*.
190. Inflorescence branches stout, almost as thick as twigs, ultimate branchlets not exceeding c. 1 cm. long, inflorescence compact, not spreading 191.  
Inflorescence branches slender, thinner than twigs, ultimate branchlets usually over 1 cm. long, inflorescence spreading .. .. 195.
191. Leaves almost sessile, drying greenish or pale brown .. .. (37) *viridescens*.  
Leaves distinctly petioled, drying brown or red .. .. 192.
192. Primary nerves very fine on under surface of leaf, or invisible, intramarginal obscure or not more than 1 mm. from margin .. .. 193.  
Primary nerves distinct below, intramarginal distinct and 2-5 mm. from margin .. .. 194.
193. Leaves rather thick, more or less caudate acuminate, inflorescences almost sessile .. .. (63) *Pearsoniana*.  
Leaves thick, not caudate acuminate, inflorescences peduncled .. .. (39) *inasensis*.
194. Leaves nearly as broad as long, very shortly narrowed to base, apex with very short broad point .. .. (50) *Kiohii*.  
Leaves narrowly elliptic or oblong, more than twice as long as broad, base cuneate, apex more or less acute .. .. (50) *Kiahii* var. *angustifolia*.
195. Leaves almost or quite sessile, or petioles less than 5 mm. long .. .. 196.  
Leaves distinctly petioled, petioles usually c. 1 cm. long or more .. .. 197.
196. Inflorescence branches with smooth bark, strongly 4-angled, almost winged, leaves drying reddish or brownish; lowland plant .. .. (73) *oleina*.  
Inflorescence branches terete or slightly compressed, bark striate, leaves drying greenish or pale brown; mountain plant .. .. (37) *viridescens*.

197. Inflorescences usually below leaves, fruit ovoid oblong, petioles often 2 cm. long; cultivated (93) *Cumini*.  
 Inflorescences terminal or from upper axils, fruit more or less globose, petioles rarely reaching 2 cm.; wild .. 198.
198. Apex of leaf with very short abrupt point, margin crenulate .. (114) *pseudocrenulata*.  
 Apex of leaf acute or acuminate, margin entire .. 199.
199. Nervation invisible or very obscure on lower surface of leaf .. 200.  
 Nervation, at least primary nerves, easily visible below .. 201.
200. Inflorescence branches with smooth bark, strongly 4-angled; lowland tree .. (73) *oleina*.  
 Inflorescence branches with striate bark, terete or slightly compressed; mountain tree (39) *inasensis*.
201. Inflorescence branches with smooth bark, sharply 4-angled .. 202.  
 Inflorescence branches with striate bark, terete or more or less compressed, not sharply 4-angled, or if angled, bark not smooth .. 203.
202. Calyx tube often slightly swollen near base, c. 5 mm. long, inflorescence branches usually ascending, leaves usually c. 4 cm. broad, elliptic oblong, oblong lanceolate, or sometimes obovate (80) *tumida*.  
 Calyx tube not swollen at base, c. 3-3.5 mm. long, inflorescence branches often horizontal, leaves usually narrow lanceolate, rarely more than c. 3 cm. wide .. (73) *oleina*.
203. Primary nerves spaced and sufficiently distinct from secondaries on under surface of leaf 204.  
 Primary nerves close together, numerous and hardly or not distinguishable from secondaries 206.
204. Inflorescences dense, many branched, terminal, rarely axillary, branches ascending .. 205.  
 Inflorescences lax, few branched, terminal and axillary, branches often horizontal (103) *cerasiformis*.
205. Leaves drying dark, usually blackish brown, more or less acuminate, calyx usually c. 6 mm. long (68) *inophylla*.  
 Leaves drying pale-brown, bluntly acute, calyx not more than 5 mm. long (50) *Kiahii*. var. *angustifolia*.

206. Mature flower buds less than 5 mm. long, rather abruptly narrowed at base, the fine nerves and reticulations raised on both surfaces of leaf  
(69) *Bernardi*.  
Mature buds more than 5 mm. long, gradually narrowed to base, nerves and reticulations hardly raised above .. .. 207.
207. Calyx tube usually slightly swollen near base, leaves elliptic oblong to obovate, rarely more than 10 cm. long .. .. (80) *tumida*.  
Calyx tube not swollen near base, leaves narrowly ovate or elliptic, usually over 10 cm. long  
(68) *inophylla*.

## GROUP 4

Calyx tube narrowly funnel shaped, tapering evenly from apex to base, but often contracted at base into a pseudostalk, glandular, pustulate, or deeply wrinkled, often pruinose or glaucous, calyx lobes rather conspicuous, broad, not spreading but more or less incurved or continuing the line of the calyx tube.

1. Flowers in rather dense heads or condensed panicles, conspicuously bracteate, the bracts often papery, and as long as or longer than flowers .. .. 2.  
Bracts small and inconspicuous or none .. 5.
2. Leaf bases broad and more or less cordate, primary nerves strongly raised below, intramarginal nerve conspicuous, petiole strongly transversely wrinkled  
(115) *tetraptera* var. *pseudotetraptera*.  
Leaf bases narrowed on to petiole, or more or less rounded, never cordate, primary nerves usually faint or invisible below, intramarginal nerve obscure, petiole not or only slightly transversely wrinkled .. .. 3.
3. Flowers in condensed panicles .. (116) *polita*.  
Flowers in sessile heads .. .. 4.
4. Leaves thin, up to c. 6 × 2.5 cm., often strongly black dotted below, calyx not pustulate  
(118) *jasminifolia*.  
Leaves thick, up to c. 3 × 1.75 cm., not black dotted below, calyx minutely pustulate  
(119) *nitidula*.

5. Leaves with primary nerves and intramarginal nerves strongly raised below, twigs with conspicuous wavy wings .. (115) *tetraptera*.  
Primary and intramarginal nerves obscure and faint below, twigs angled or not, but without wavy wings .. 6.
6. Leaves small, very thick, not exceeding c. 2.5 cm. long .. 7.  
Leaves larger, not very thick, usually at least 4 cm. long and often longer .. 8.
7. Leaves broadly ovate, usually c. 2.5 cm. broad, almost sessile, base cordate, calyx not or only slightly pustulate .. (120) *clypeolata*.  
Leaves narrower, not more than c. 1.5 cm. broad, usually less, usually distinctly petioled, not cordate, calyx conspicuously pustulate .. (121) *Stappiana*.
8. Calyx conspicuously pustulate .. (122) *spicata*.  
Calyx wrinkled, not pustulate .. 9.
9. Inflorescence paniced, calyx c. 5-6 mm. long, glaucous .. (123) *grata*.  
Flowers in fascicles, calyx c. 1 cm. long, not glaucous .. (117) *tecta*.

## GROUP 5

Calyx tube elongate, usually 1 cm. or more long (except *leucoxylon* and *flosculifera*), fusiform, or gradually narrowed from apex to base, or clavate or pegshaped (suddenly contracted into a long tapering pseudostalk).

1. Calyx small, c. 2.5 mm. long, fusiform, cotyledons fused .. (126) *flosculifera*.  
Calyx longer, cotyledons free .. 2.
2. Calyx not exceeding 1 cm. long .. 3.  
Calyx over 1 cm. long .. 6.
3. Calyx clavate, gradually narrowed to base, leaves more or less orbicular, cordate, apex rounded or retuse; shrub .. (124) *spissifolia*.  
Calyx pegshaped, abruptly contracted into a long pseudostalk, leaves not orbicular, narrowed at base, apex acute or acuminate; trees .. 4.
4. Calyx c. 3-4 mm. long, inflorescence spreading, fruit globular, bark of twigs pale .. (125) *leucoxylon*.  
Calyx c. 6-10 mm. long, inflorescences not spreading, fruit elongate, bark of twigs dark .. 5.
5. Leaves rarely exceeding c. 6 cm.  $\times$  2.5 cm., nervation almost invisible, calyx more or less pustulate, bark of trunk papery flaky .. (127) *attenuata*.

- Leaves larger, up to c. 14 cm.  $\times$  6 cm., primary nerves below usually easily visible, calyx smooth, bark of trunk not or only slightly papery flaky (129) *rugosa*.
6. Calyx tube fusiform—contracted below lobes and swollen about ovary .. (132) *virens*.  
Calyx tube pegshaped or clavate .. 7.
7. Apex of calyx tube much inflated and more or less globular .. (130) *fusticulifera*.  
Apex of calyx tube not inflated or globular .. 8.
8. Inflorescences very short, fascicled, almost or quite sessile .. 9.  
Inflorescences peduncled, not fascicled .. 11.
9. Leaves usually less than 7 cm.  $\times$  2.5 cm., primary nerves below indistinct or invisible (133) *pseudoclaviflora*.  
Leaves usually over 9 cm.  $\times$  3.5 cm., primary nerves below spaced and distinct from secondaries even if slender .. 10.
10. Stamens 5–10 mm. long, calyx tube c. 1.5 cm. long, bark of trunk greyish, not fissured (134) *claviflora*.  
Stamens not reaching 4 mm. long, calyx tube less than 1.5 cm. long, bark of trunk reddish and fissured .. (129) *rugosa*.
11. Leaves with very fine close nervation raised on both surfaces, primary nerves close together, not distinguishable from secondaries (128) *rhamphiphylla*.  
Primary nerves distant and distinct from secondaries, nerves not or only slightly raised above .. 12.
12. Calyx tube strongly wrinkled, mouth of calyx opening widely after anthesis (131) *napiiformis*.  
Calyx tube nearly smooth, mouth contracted below lobes, not opening widely .. (129) *rugosa*.
1. *Eugenia malaccensis* Linn., Sp. Pl., 470 (1753); Duthie in Hook. fil., F.B.I., II, 471; King, Mat. F.M.P., No. 12, 82; Gagnep. in Fl. Gen. Indo-Ch., II, 839; Koord. & Valet. in Meded. Lands Plantent., XL, 55; Atlas Baumart. Jàva, III, fig. 445; Ridl., F.M.P., I, 724; Corner, Wayside Trees of Malaya, p. 499. *Syzygium malaccense* (L.) Merr. & Perry in Journ. Arn. Arb., XIX, 215 (1938); Mem. Amer. Acad. Arts & Sci., XVIII, 3, 154. (Fig. 6a).

Widely cultivated in the Malay Peninsula. Malay name, *Jambu Bol*.

A medium sized tree. *Twigs* stout, compressed or angled or nearly terete, the youngest with brown bark, the older with pale smooth bark. *Leaves* usually large, but variable in shape and size, from oblong oblanceolate to oblong elliptic or somewhat obovate, coriaceous, drooping, reaching c. 35–36 cm. long and 18 cm. broad, apex obtuse or shortly and abruptly acute, base cuneate or long narrowed;

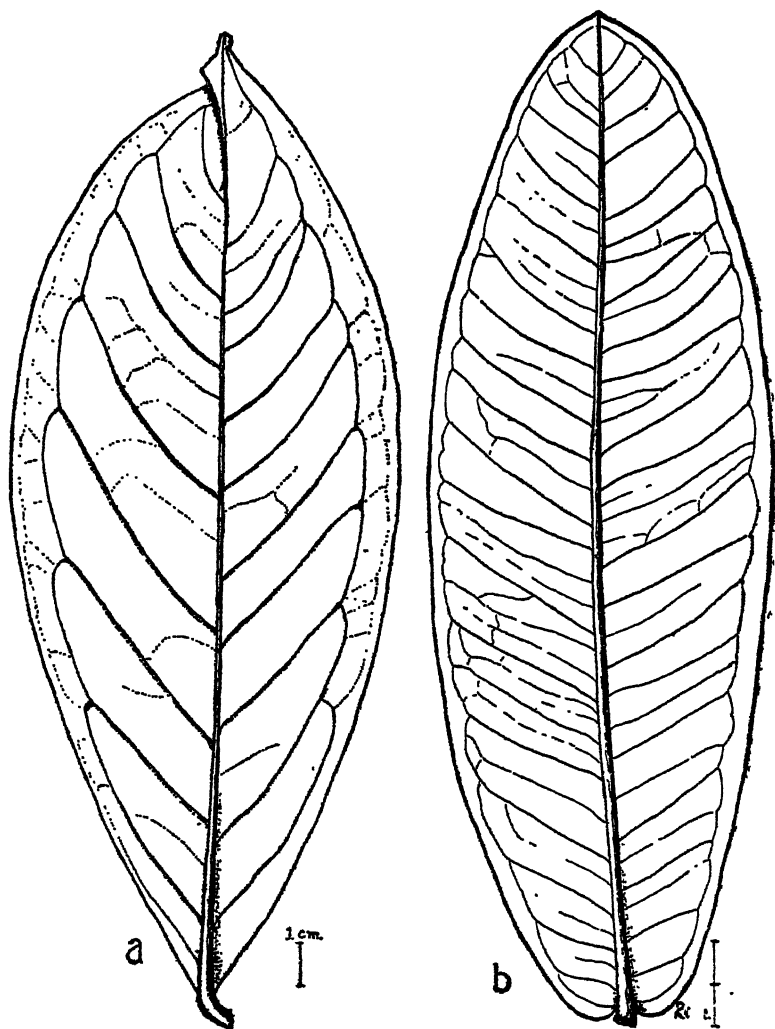


Fig. 6. a, *E. malaccensis*; b, *E. auriculata*.

upper surface drying pale brown or olivaceous brown to dark reddish brown, lower surface pale brown to pale reddish brown, with scattered black dots; midrib rather shallowly impressed above, prominent below; *primary nerves* c. 10–14 pairs, 1–2.5 cm. apart, usually more or less impressed and inconspicuous above, prominent below, obliquely ascending, nearly straight or curving up to a conspicuous looped intramarginal nerve 0.5–1.5 cm. from the leaf margin, with one or two fainter series of loops closer to the margin; secondaries much less prominent than primaries below, reticulations lax and usually faint; petiole stout, 1 cm. or less long.

*Flowers* crimson pink, in short few flowered fascicles from twigs below the leaves, sessile; *calyx* green, c. 3 cm. long and 1.5 cm. across mouth, excluding lobes, obconic, the upper part more or less cupular, narrowed into a very stout pseudostalk c. 1 cm. long which is often obscurely ribbed; lobes 4, unequal, suberect, persistent, broad and rounded, 1.2–1.5 cm. across, the smaller c. 5–6 mm. tall, the larger 9–10 mm. tall; *petals* 4, free, orbicular-spathulate with a broad short claw, thick textured, gland dotted, c. 1.7 cm. tall; *stamens* numerous, filaments slender, flattened below, terete above, reaching c. 3 cm. long, anthers oblong, a little more than 1 mm. long, connective gland small and inconspicuous; *style* stout, subulate, reaching c. 3.5 cm. long; *ovary* 2-celled, multiovulate.

*Fruit* oblong or obovoid oblong, 4 cm. long and 2.5 cm. diam., but often larger, white or greenish white, wholly or partially overlaid with pink, apex with the 4 enlarged incurved green calyx lobes and long pinkish style; pericarp thick, white, dryish, somewhat fibrous and pithy; seed depressed globose, c. 1.5–2 cm. diam.; testa brownish, thick, toughly fibrous, adhering closely to the white, glistening very rugose surface of the cotyledons; cotyledons nearly equal or very unequal, inner faces green tinged pink, attached to the hypocotyle by broad stalks twisted through 90 degrees; hypocotyle stout, reaching periphery of the seed. Germination hypogeal.

## 2. *Eugenia tekuensis* nom. nov.

*E. trunciflora* Ridl., F.M.P., I, 724 (1922), non G. Don (1832) nec Rich. ex Berg. (1859–60). *E. cauliflora* Ridl. in Trans. Linn. Soc., III, 299 (1893), non DC. (1828) nec Miq. (1849) nec Berg. (1855). (Fig. 7).

PAHANG: Tahan Woods, *Ridley s.n.*; Kuala Teku, *Ridley 16266* (type); Sungai Teku, *SFN 31710 (Kiah)*.  
*Distrib.*: Endemic.

A small slender *tree* 8-13 metres tall, bark smooth, dark brown. Youngest *twigs* slender, with smooth brown bark. *Leaves* coriaceous, elongate, oblong lanceolate, up to c. 44 cm. long and 7 cm. broad, gradually acuminate in the upper 1/3 or 1/4, or sometimes from near the base, apex

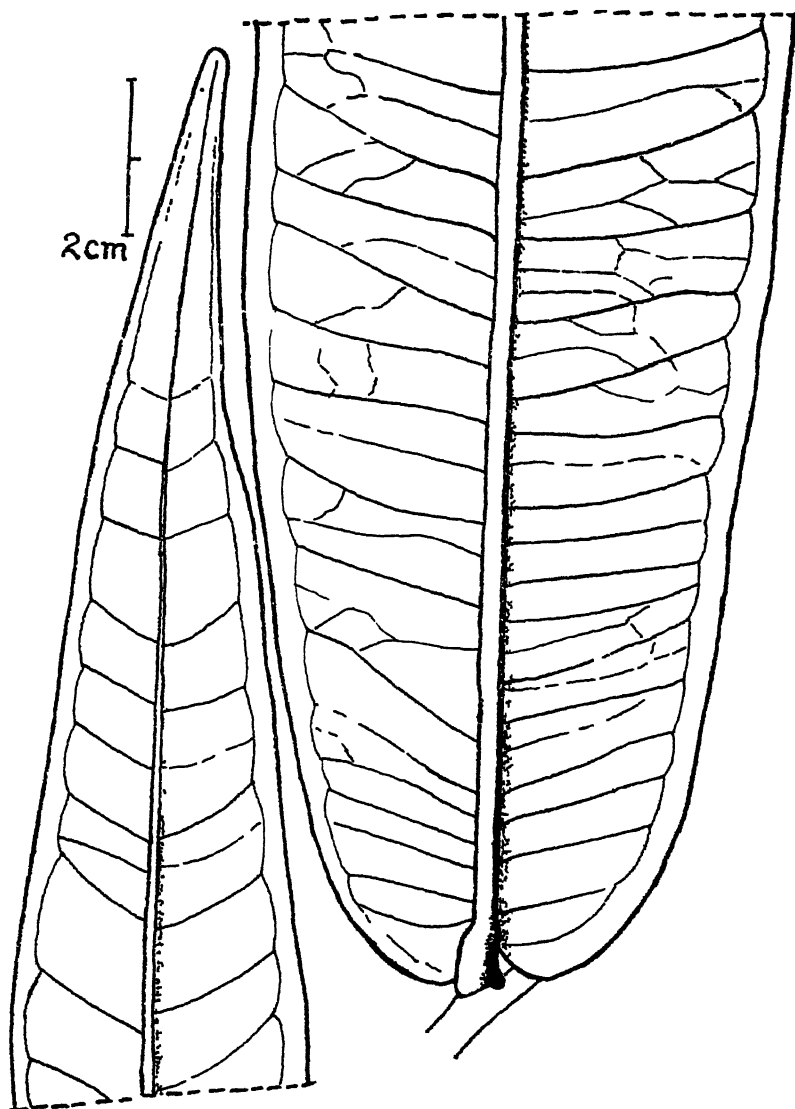


Fig. 7. *E. tekensis*, apex and base of leaf.

acute or subacute, base broad, sometimes slightly narrowed, rounded and cordate; petiole very short, swollen and wrinkled; midrib impressed above, prominent below, rounded and more or less longitudinally striate; *primary nerves* 25-40 or more pairs, slightly raised and indistinct above, raised and slender below but distinct, about 1 cm. apart, nearly horizontal or at various angles to the midrib, curving up slightly to a somewhat faint intramarginal nerve c. 2-4 mm. from leaf margin; secondaries and reticulations faint above, secondaries below almost as conspicuous as primaries and sometimes not easy to distinguish from them, reticulations lax and faint; upper surface drying reddish or blackish brown, lower surface glaucous (fide Ridley), reddish brown in *SFN 91710*.

*Inflorescences* from tubercles on the trunk, short, few flowered, sessile or on a peduncle c. 2 cm. long, the peduncle and branchlets slender, 4-angled with brown striate bark. *Calyx* c. 1.2 cm. long, c. 8 mm. across mouth in full grown bud, obconic, narrowed rather abruptly into a slender pseudostalk 2-5 mm. long, pedicel varying between the same limits; *sepals* 4, persistent, broadly ovate, rounded, the two inner ones c. 6 mm. across at base and 3 mm. tall, the outer ones smaller; *petals* 4, ovate rotund, unequal, thin textured, the larger nearly 1 cm. across; *stamens* numerous, slender, up to c. 2.5 cm. long, anthers small, oblong, with a rather conspicuous dark coloured connective gland; *style* slender, about the same length as the stamens; ripe fruit unknown.

Ridley describes (in F.M.P.) the flowers as entirely crimson. His field note on the type says they are scarlet. Very young fruits on *SFN 91710* are described as pink.

3. *Eugenia malayana* Gagnep. in Fl. Gen. Indo-Chine, II, 838 (1920). *Jambosa confusa* Bl., Mus. Bot., I, 101 (1849-51). *Eugenia "doligophylla"* Koord. & Valet. in Meded. Lands Plantent., XL, 78 (1900); ? *E. dolichophylla* Koord. & Valet., Atlas Baumart. Java, III, fig. 462; non *E. dolichophylla* Kiaersk. (1893).

KELANGAN: Bukit Bunga Raya, Forest Dept. FMS 3341.

*E. "doligophylla"* Koord. & Valet. is a misprint or mistake for "*dolichophylla*". The name is a later homonym, having been used by Kiaerskou in 1893 for a Brazilian species. Koorders & Valet's name was a new name for *Jambosa confusa* Bl., which in its turn was part of *Jambosa lanceolata* Korth., regarded by Blume as a mixture and split by him into three parts—*J. insignis*, *J. Korthalsii* and *J. confusa*. In 1920 Gagnepain gave the name *E. malayana* to *Jambosa confusa* Bl., but did not cite *E. dolichophylla* Koord. & Valet.

Koorders and Valetton do not give a fresh description of the species, but merely repeat Blume's description. In their figure in *Atlas Baumarten v. Java*, where the spelling of the specific name is corrected, the inflorescence appears not to be terminal, as all descriptions give it, but cauliflorous or ramiflorous, and the figure, therefore, is more like *E. tekuensis*.

As no material of *E. malayana* has been available for comparison, the specimen cited is placed here with some doubt. A short description of it is given below.

A tree c. 7-8 metres tall. *Twigs* terete, drying reddish. *Leaves* narrowly oblong, c. 44 cm. long and 7 cm. broad, tapered gradually from about middle to apex, base cordate, upper surface drying blackish brown, lower surface red brown; midrib impressed above, prominent and rounded below; *primary nerves* c. 30 pairs, 1-2 cm. apart, slightly raised and rather faint above, prominent below, the basal ones nearly horizontal, the upper ones curving up, joining a nearly straight, prominent intramarginal nerve 3-5 mm. from leaf margin, with a much fainter loop close to the margin; secondaries and lax reticulations distinct below, much less prominent than primaries; petiole short and stout, longitudinally grooved, less than 5 mm. long.

*Inflorescences* terminal, clustered, up to c. 2 cm. long, 3-5-flowered, rachis rather stout, 4-angled and grooved, drying dark; *flowers* sessile or on short stout pedicels, buds 1.7-1.8 cm. long, obovoid, *calyx* c. 1.5 cm. long, campanulate, narrowed rather gradually to a rather short stout pseudo-stalk; lobes 4, broad, ovate, rounded, 4-5 mm. tall; *petals* pellucidly gland dotted.

4. *Eugenia perakensis* King, Mat. F.M.P., No. 12, 81 (1901); Ridl., F.M.P., I, 726, excl. syn. (Fig. 8).

PERAK: sine loc., *Scortechini 185*; Larut, *Kunstler 5595*, type collection; Sungai Krian Estate, Bagan Serai, at sea level, SFN 34481 (*Spare*).

SELANGOR: Circular road Reserve, Kuala Lumpur, *Forest Dept. FMS 1576, 5750*; Klang river, *Forest Dept. FMS 48732*; Sungai Pelek, Sepang, *Denny s.n.*

*Distrib.*: Endemic.

A straggling tree, sometimes in secondary growth on river banks where at high tide the water reaches the base of the trunk; bark silvery or very pale brown, flaky, inner bark pallid buff. Youngest *twigs* with smooth brown bark, conspicuously ridged, stout, older *twigs* stout, terete, bark whitey-brown or pale brown, flaky or not. *Leaves* in pairs or threes, thickly coriaceous, oblong elliptic or oblong obovate, apex blunt or subacute, narrowed gradually to the more or less oblique, cordate, sometimes amplexicaul base,

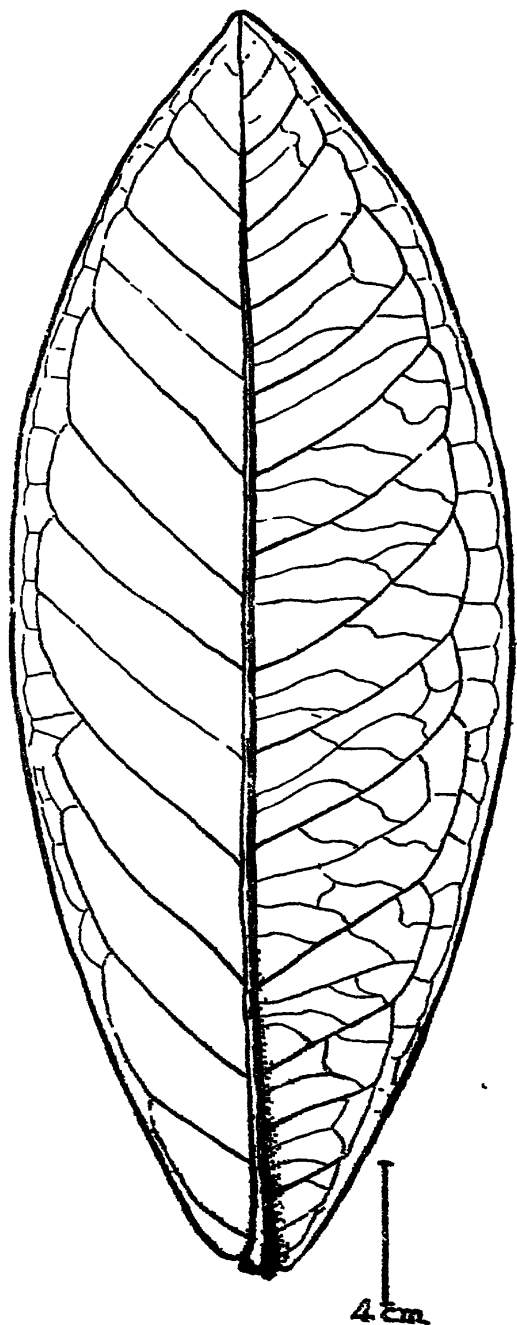


Fig. 8. *E. perakensis*.

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very variable in size, reaching c. 33 cm. long and 12 cm. broad, upper surface drying dull brown, smooth, punctate, lower pale brown to reddish brown; midrib slightly impressed above, very prominent and rounded below; *primary nerves* c. 12–14 pairs, 2–5 cm. apart, ascending and curving up to interarch 5–10 mm. from leaf margin, with a very much fainter series of arches much closer to margin, impressed or channelled and faint above, very prominent below, secondaries and reticulations much less prominent but quite distinct, the reticulations lax; petiole very short and stout.

*Inflorescences* usually from branches, always below leaves but sometimes from axils of fallen leaves; *flowers* 4–8 in very short racemes, peduncle usually less than 1 cm. long, or fascicled, pedicels very variable, up to c. 2 cm. long, subtended by a pair of triangular acute bracts c. 1.5 mm. long, and with a pair of similar but slightly broader and blunter bracteoles at apex; *calyx* campanulate, narrowed to a short pseudostalk, tube deep pink, c. 1.5 cm. long and 1.2–1.3 cm. wide at mouth; lobes 4, semiorbicular, persistent, the two inner larger than outers, c. 5 mm. high and 7 mm. wide; *petals* 4, free, subpersistent, pink, broadly ovate with truncate base, c. 1 cm. high and 8 mm. wide; *stamens* very numerous, filaments white, c. 2 cm. long, anthers narrowly oblong, 1–1.5 mm. long, connective gland very inconspicuous; *style* c. 3.5 cm. long; *ovary* 2-celled with many ovules in each cell.

*Fruit* c. 2 cm. diam., globose with truncate apex, smooth, deep purplish pink slightly tinged with green, apex with enlarged calyx rim and remains of calyx lobes and style, c. 1.5 cm. diam., the excavation shallow, white tinged pink; pericarp pithy leathery, thin; seeds 3, the testa often peeling off with pericarp; cotyledons pale orange yellow, superposed, stalked, the hypocotyle rather long, pink.

Malay name—*Kayu Kati Lima*.

5. *Eugenia aquea* Burm. f., Fl. Ind., 114 (1768); Duthie in Hook. fil., F.B.I., II, 473; Ridl., F.M.P., I, 724; Koord. & Valet. in Meded. Lands Plantent., XL, 82 (1901); Atlas Baumart. Java, III, figs. 465, 466; Corner, Wayside Trees of Malaya, p. 494. *Syzygium aqueum* (Burm. f.) Alston in Ann. Roy. Bot. Gard. Peradeniya, XI, 204 (1929); Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 170. (Fig. 9a).

Cultivated in the Malay Peninsula under the Malay names *Jambu Ayer*, *Jambu Chili*. Perhaps a native of Southern India.

A *bush* or small *tree* up to c. 10 m. tall, usually much branched, bark smooth, grey. *Twigs* terete with smooth brown bark. *Leaves* decussate, usually ovate oblong or elliptic oblong, up to c. 20 cm.  $\times$  10 cm., apex shortly and broadly acute, or blunt, base rounded and usually slightly cordate, almost sessile, petiole less than 5 mm. long; upper surface dull green in life, drying reddish to blackish, paler below, black dotted, drying reddish brown; midrib channelled above, boldly raised below; *primary nerves* up to about 10 pairs, 1–2 cm. apart, ascending, somewhat impressed above when fresh, more or less raised and slender when dry, raised below, meeting in a looped intramarginal nerve c. 5–7 mm. from leaf margin, with a much finer and fainter loop nearer the margin; secondaries and reticulations faint.

*Inflorescences* axillary, terminal, or from immediately below leaves, shorter than leaves, c. 5 cm. long, peduncle up to 2 cm. long or almost none, with or without a pair of ascending branchlets near the base c. 2–2.5 cm. long, each with 1–3 flowers, the central rachis usually with 5 flowers; rachis and branchlets green in life, and slightly angled, dark brown and striate when dry; bracts and bracteoles small and fugacious. *Flowers* white, greenish or pinkish, *calyx* including pseudostalk c. 1.4 cm. long, hemispherical or oblong above, abruptly contracted into a pseudostalk c. 5 mm. long, lobes 4, erect, not reflexed after anthesis, broadly ovate rounded, c. 4 mm. across at base and 3 mm. high, the calyx tube slightly contracted below lobes; *petals* 4, subsistent, free, reflexed after anthesis, subrotund, unguiculate at base, c. 5 mm. diam.; *stamens* numerous, up to c. 1.5 cm. long, filaments slender, subulate, anthers small, elliptic, the connective gland very small and inconspicuous; *style* yellowish, c. 1 cm. long, stouter than filaments; *ovary* 2-celled, many ovuled.

*Fruit* shining white or pink, up to c. 4 cm. across, turbinate with flattened top, the 4 much enlarged and fleshy calyx lobes incurved over and almost hiding the apical excavation, flesh crisp and juicy, often seedless or with several seeds. *Seed* very like that of *E. javanica*, with thick closely adhering pithy testa, surface of cotyledons green, rugose, the internal structure the same as in *E. javanica*, *E. malaccensis* etc., the cotyledons attached to the hypocotyle by broad stalks.

6. *Eugenia auriculata* Ridl. in Journ. Roy. As. Soc. Str. Br., LXI, 7 (1912); F.M.P., I, 726. (Fig. 6a).

*DINDINGS*: near Lumut, Ridley 3176 (type collection).

*Distrib*: Endemic.

? A *tree*. *Branchlets* very stout, terete, with smooth or slightly cracked greyish or brownish bark. *Leaves* very

coriaceous, narrowly elliptic, up to c. 23 cm. long and 8 cm. broad, apex apparently shortly acute, lower half of lamina gradually narrowed to a cordate-auriculate base; upper surface drying lead colour, lower surface brown to blackish brown; petiole very stout, short, black, less than 5 mm. long; midrib sunk in a narrow channel above, boldly raised below, blackish and striate; *primary nerves* c. 13–14 pairs, somewhat raised and finely channelled above, rather conspicuous, raised below and somewhat inconspicuous, running straight from midrib and joining an inconspicuous intramarginal nerve c. 3–4 mm. from leaf margin; secondaries almost as conspicuous as primaries but distinguishable from them, reticulations very faint; upper surface of leaf slightly polished, punctate with scattered black dots, lower surface dull, not punctate.

*Inflorescences* terminal or axillary, 2–3 cm. long, on short, very stout peduncles c. 1 cm. long, or almost sessile, branchlets very short, stout, with blackish or brownish wrinkled bark; *flowers* in threes, white (fide Ridley), sessile; *calyx* campanulate, c. 1.4 cm. long and 1.2 cm. across mouth, base narrowed, pseudostalk none, or very short and stout, not exceeding 2 mm. long when present; calyx lobes apparently soon deciduous, none seen attached to flowers, semiorbicular, strongly gland dotted, 5–6 mm. diam; *petals* free, semiorbicular, c. 5 mm. diam., finely gland dotted; *stamens* numerous, c. 2.5 cm. long, slender, with small anthers; *style* slender, c. 3 cm. long. *Fruit* unknown.

Very little material is known of this species. It is close to *E. perakensis* but appears sufficiently distinct in the less prominently nerved leaves, terete, not angled twigs and in the terminal or axillary inflorescences on short peduncles.

7. *Eugenia quadrata* King, Mat. F.M.P., No. 12, 86 (1901); Ridl., F.M.P., I, 730. (Fig. 9b).

PERAK: Larut, *Kunstler* 5547 (type collection).

*Distrib.*: Endemic.

A tree up to c. 10 m. tall. *Twigs* stout, 4–5 mm. diam., 4-angled and narrowly winged, bark smooth, brown; *Leaves* coriaceous, oblong, much narrowed to the acuminate apex, base slightly narrowed, rounded and cordate, up to c. 25 cm. long and 7.5 cm. broad; upper surface drying brown or olivaceous brown, smooth and punctate, lower surface darker brown or reddish brown, not glandular; midrib impressed above in a narrow channel, raised below; *primary nerves* up to c. 25 pairs, 5–10 mm. apart, obscure above, raised and slender below, almost horizontal and meeting in a fine intramarginal nerve 2–4 mm. from leaf margin, with

a much finer loop closer to margin; secondaries and reticulations fine, raised below and distinctly less conspicuous than primaries; petiole 2-3 mm. long, swollen.

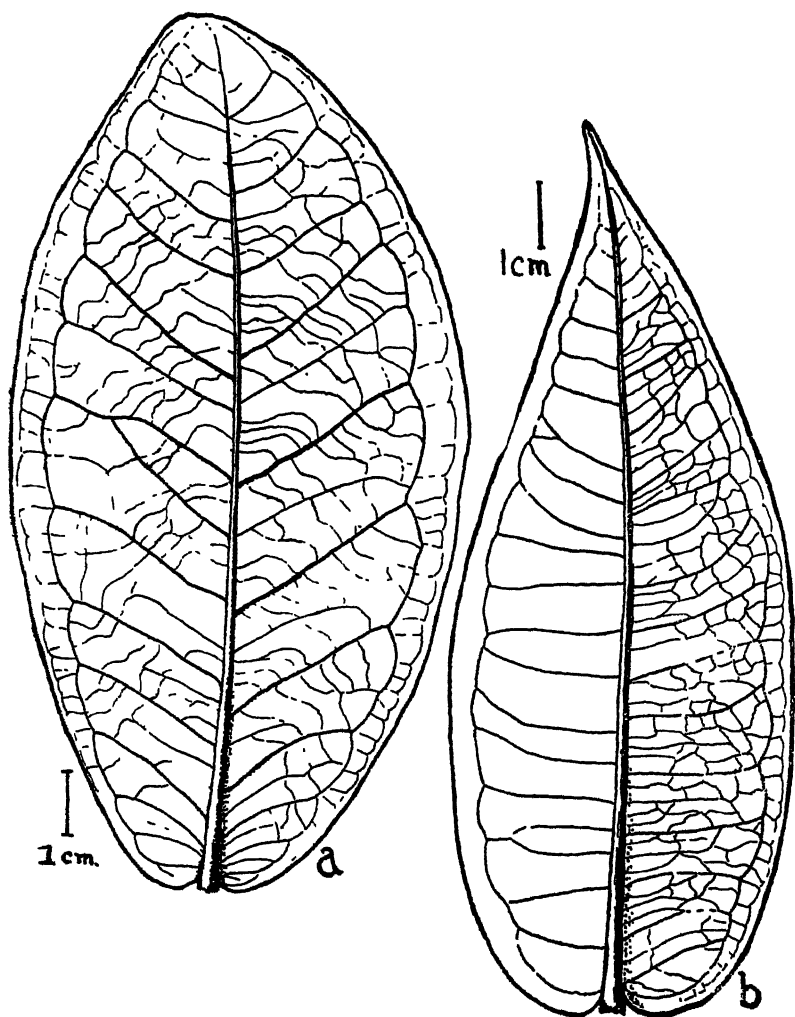


Fig. 9. a, *E. aquea*; b. *E. quadrata*.

*Inflorescences* terminal or axillary, much shorter than leaves, solitary or fascicled in groups of 3 or 4, 3-flowered, branchlets compressed and striate; *flowers* white, sessile, *calyx* tube c. 1.2 cm. long and 5 mm. across mouth, campanulate, narrowed rather abruptly or gently into

a rather slender pseudostalk c. 4 mm. long, lobes 4, broadly ovate triangular, rounded, c. 3 mm. across at base and 2 mm. tall, persistent and eventually reflexed; *petals* 4, free, orbicular, c. 5 mm. diam.; *stamens* numerous, c. 5 mm. long, filaments very slender, subulate, anthers oblong with a dark conspicuous connective gland; *style* much stouter than filaments, c. 1 cm. long. *Fruit* unknown.

The only specimens of this species are very scanty and poor, yet it seems distinct from all others, especially in the oblong broad based leaves with a long tapering apex, the stout angled and winged twigs and the short crowded inflorescences.

8. *Eugenia scalarinervis* King, Mat. F.M.P., No. 12, 87 (1901). (Fig. 10).

PERAK: Gopeng, 300–500 feet, *Kunstler 8200* (syntype); Parit Forest Reserve, *Forest Dept. FMS 34227*.

DINDINGS: Lumut, *Ridley 3095* (syntype).

*Distrib*: Endemic.

A tree c. 10 m. tall. *Branchlets* stout, 8 mm. or more in diam. with dull red brown smooth or finely striate and lenticellate bark. *Leaves* very coriaceous, large, elliptic ovate, subacute, base cordate, rounded, c. 35 cm.  $\times$  20 cm., upper surface drying dull brown or blackish brown, minutely and closely punctate, lower surface paler, not, or very sparsely glandular; midrib impressed above, bold and rounded below; *primary nerves* up to c. 30 pairs, impressed above, very prominent below, 1–2 cm. apart, ascending slightly and running nearly straight to a well marked looped intramarginal nerve 5–10 mm. from leaf margin, with a much fainter loop nearer the margin; reticulations wide and few, impressed above, raised below but much less prominent than primaries; petiole up to c. 1 cm. long, very stout.

*Inflorescences* terminal, few flowered, short and contracted; *calyx* tube magenta coloured (fide *Kunstler*), c. 2 cm. long, contracted at base into a pseudostalk 3–4 mm. long, pedicel about as long, lobes 4, broadly triangular, c. 4 mm. tall; *petals* not seen; *stamens* 5–7 mm. long. *Style* c. 3 cm. long. *Fruit* (apparently unripe) globular ovoid, smooth, crowned by the wide calyx tube c. 5 mm. tall, fringed by the persistent and more or less enlarged calyx lobes.

Ridley reduces this striking species to *E. perakensis*, but although only rather poor material of it is known, it is quite distinct in the larger broader leaves with a very broad base, the nerves deeply impressed on the upper surface and prominent below, the primary nerves 1–2 cm. apart, and in the terminal inflorescence. In *E. perakensis* the nerves

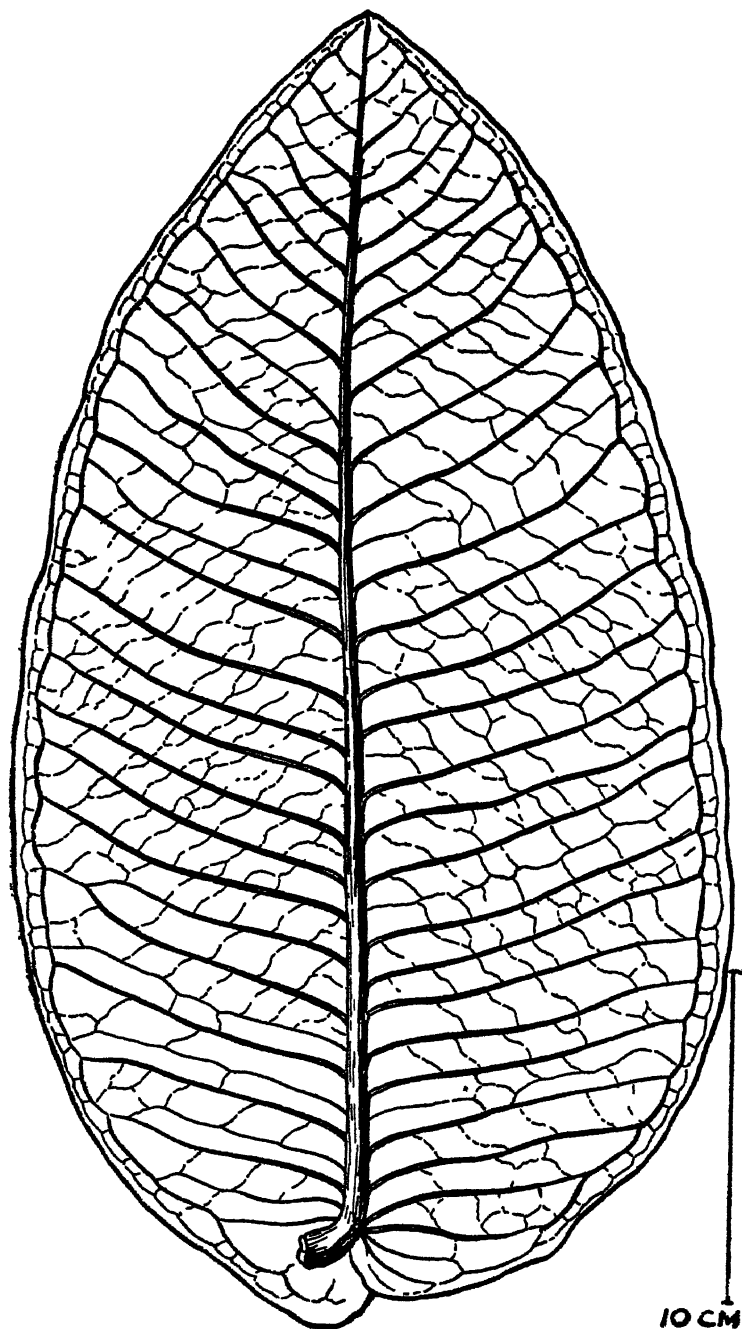


Fig. 10. *E. scalarinervis*.

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are not deeply sunk above, the reticulations are only slightly raised below, the primary nerves are 2-4 cm. apart and the leaves are more or less narrowed to the base. The inflorescence is below the leaves or on the trunk.

9. *Eugenia porphyranthera* Ridl. in Journ. Roy. As. Soc. Str. Br., LXI, 8 (1912); F.M.P., I, 727. (Fig. 12a).

SELANGOR: Bukit Kutu, Ridley 7513 (type collection).

Distrib: Endemic.

A tree (fide Ridley). Twigs very slender, terete with faint raised lines between the nodes, the youngest parts 4-angled, bark smooth, pale brown. Leaves broadly lanceolate or somewhat ovate lanceolate, up to 15 cm.  $\times$  5 cm., long tapered to an acuminate apex with rounded tip, base rounded and slightly cordate; petiole c. 4 mm. long, somewhat swollen, with black wrinkled bark; midrib impressed above, bold below; primary nerves 12-16 pairs, fine above and raised above the leaf surface in channels, giving the effect of being impressed, slender below but raised and conspicuous, running straight to a conspicuous looped intramarginal nerve c. 4-5 mm. from leaf margin, with a much fainter intramarginal c. 1 mm. from margin and traces of a third very close to margin; secondaries and reticulations very fine and raised above, more conspicuous below; both surfaces drying dull, the upper to a lead colour or dark blackish brown, the lower similar, when dark brown with very minute crowded pale gland dots.

Inflorescence 2-flowered (3-flowered, fide Ridley) on a very short peduncle, terminal; calyx obconic, c. 1 cm. long, 7-8 mm. across mouth, on a pedicel c. 3 mm. long, narrowed rather abruptly to a pseudostalk c. 3 mm. long; in the material available the calyx lobes are apparently large, orbicular, semipersistent, strongly gland dotted; petals not seen; stamens numerous (purple fide Ridley), c. 1 cm. long, anthers small, oblong; style c. 1.5 cm. long. Fruit unknown.

Known only from one collection but distinct in the tapered leaves and very short few flowered terminal inflorescences.

10. *Eugenia siamensis* Craib in Kew Bull. (1912) 153; Fl. Siam. Enum., I, 661; Gagnep. in Fl. Gen. Indo-Ch., II, 843; Ridl., F.M.P., I, 726. (Fig. 11a).

KELANTAN: base of Gunong near Kota Bahru, Ridley s.n.

KEDAH: Koh Mai Forest Reserve, SFN 55183 (Kiah).

PERLIS: Kaki Bukit, SFN 55264 (Kiah).

Distrib: Siam.

A shrub or small tree up to c. 3 m. tall. Twigs slender, terete, smooth, with pale brown or reddish brown bark. Leaves oblong lanceolate or ovate-lanceolate, chartaceous,

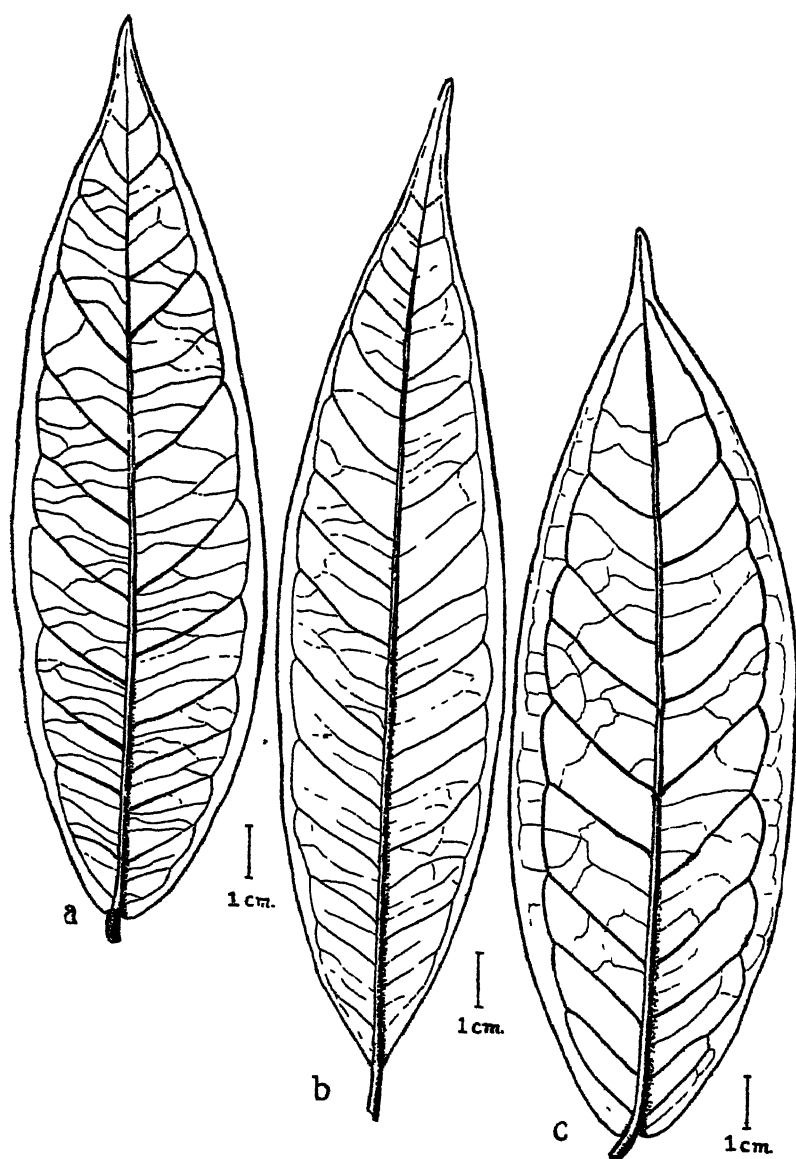


Fig. 11. a, *E. siamensis*; b, *E. Jambos*; c. *E. Scortechinii*.

apex acuminate, acute, base narrowed and rounded, or cuneate, up to 18 cm.  $\times$  5.5 cm.; upper surface drying dull greenish or brownish, eglandular, lower surface paler, very sparsely glandular, finely wrinkled; midrib more or less impressed above, prominent below; *primary nerves* up to c. 10 pairs, c. 1 cm. apart, slightly raised and inconspicuous above, raised and distinct below, more or less ascending or curving gently to a shallowly looped intramarginal nerve 3–7 mm. from leaf margin, secondaries and reticulations obscure above, very fine below; petioles 5–8 mm. long, rather stout and wrinkled.

*Inflorescences* terminal, 3-flowered, peduncle rather stout, angled, c. 5 mm. long, the pedicels slightly less stout, 3–5 mm. long; *calyx* tube funnel shaped, c. 1.5–2 cm. long, 1.3 cm. across mouth, gradually narrowed to a very short stout pseudostalk 2–3 mm. long, lobes 4, broad and rounded, persistent, c. 1 cm. across at base and 5–7 mm. tall; *petals* 4, free, conspicuously gland dotted, orbicular, c. 1.7 cm. diam.; *stamens* numerous, c. 3 cm. long, filaments slender, anthers linear oblong, c. 1 mm. long, connective gland apparently none; *style* stouter than stamens, 4–5 cm. long; *fruit* globose, c. 3 cm. diam. (probably unripe), apex rather widely and shallowly excavate, bearing the persistent calyx lobes and style.

This species is perhaps a little too close to *E. Jambos* but it differs from it mainly in the broader leaves with a less narrowed base and in the fewer primary nerves and less conspicuous reticulation. The flowers are described as red in two of the collections cited above. Ridley describes them as rose at the base and white above, the stamens rose pink. The flowers of *E. Jambos* are normally white.

11. *Eugenia oreophila* Ridl. in Journ. Roy. As. Soc. Str. Br., LXI, 9 (1912); F.M.P., I, 753; *E. jugalis* Ridl. in Journ. F.M.S. Mus., VI, 47 (1915); F.M.P., I, 727. (Fig. 12b).

An endemic species not uncommon on hilltops and in ridge forest in Perak, Pahang and Selangor, from 4,000–5,500 feet. The type is *Dennys s.n.* from Ulu Semangkok, Selangor.

A *shrub* or bushy *tree* up to c. 8 m. tall. *Twigs* rather slender, terete, with smooth dark brown bark, the youngest parts paler and often densely lenticellate. *Leaves* coriaceous, variable in size and shape, usually broadly elliptic, sometimes obovate or nearly orbicular, from c. 2.5–9 cm. long and 1.5–5 cm. broad, apex usually rounded, sometimes retuse or very shortly and broadly acute, base narrowed rather abruptly; petiole rather slender, drying black and wrinkled, deeply and narrowly channelled above, up to c. 1 cm. long; midrib impressed above, bold below;

*primary nerves* from about 4 pairs in small leaves to 9 or 10 in large leaves, from 5–10 mm. apart, raised on upper surface and very slightly more distinct than secondaries and reticulations, raised below and just distinguishable from secondaries, meeting in a looped intramarginal nerve 3–4 mm. from leaf margin; upper surface often shining, greenish brown, lower dull and paler, minutely black dotted.

*Inflorescences* terminal, up to c. 4.5 cm. long but usually shorter, few flowered, branchlets slender, terete; *calyx* tube more or less campanulate, c. 1 cm. long, including pseudostalk, c. 5 mm. diam. below lobes, narrowed rather abruptly into a slender pseudostalk c. 3–4 mm. long; lobes 4 broad and rounded, varying in size, one usually considerably larger than the others; *petals* 4, free, obovate orbicular, c. 8 mm. tall and 7 mm. broad; *stamens* numerous, c. 1.5 cm. long, anthers oblong, connective gland inconspicuous; *style* 1.5 cm. long.

*Fruit* globose, c. 1.5–1.75 cm. diam., dull brown or blackish brown, surface rugulose when dry; apical umbilicus shallow, c. 7.5 mm. diam., calyx rim very short, bearing the shrivelled lobes which persist until the fruit is ripe or nearly so, style base stout, c. 2 mm. long; pericarp probably fleshy and somewhat fibrous; seed 1, testa thick, brown, adhering to cotyledons; cotyledons nearly equal, gland dotted, inner faces plane or concave, attached to hypocotyle near their centres.

There is no significant difference to be found between the types of *E. oreophila* and *E. jugalis*, although Ridley puts them in widely separated sections of his key. The petals in both are free.

12. *Eugenia Jambos* Linn., Sp. Pl., 470 (1753): Duthie in Hook. fl., F.B.I., II, 474; King, Mat. F.M.P., No. 12, 82; Gagnep. in Fl. Gen. Indo-Ch., II, 834; Koord. & Valet., Atlas Baumart. Java, III, fig. 444; Ridl., F.M.P., I, 724; Corner, Wayside Trees of Malaya, p. 499, pl. 150. *Syzygium Jambos* (L.) Alston in Trimen, Fl. Ceylon (Suppl.) VI, 115 (1931); Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 165. (Fig. 11b).

Widely cultivated in the Malay Peninsula and other tropical countries. The Rose Apple or *Jambu Mawar*.

A bush or small tree. Twigs angled or compressed, eventually subterete, drying brown. Leaves coriaceous, lanceolate or oblong lanceolate, long tapered to the acuminate apex, base long narrowed, up to c. 20 cm. long

and 5 cm. broad, both surfaces drying greenish brown to reddish brown and obscurely pustulate; petiole up to c. 1 cm. long; midrib impressed above, prominent below; *primary nerves* c. 10–15 pairs, 1 cm. or more apart, slightly raised and rather faint above, elevate and distinct below, ascending and curved up to a distinct, shallowly looped sometimes interrupted intramarginal nerve 3–5 mm. from leaf margin, with usually a much fainter loop nearer the margin; secondaries and reticulations raised on both surfaces, often obscure above, distinct below but less prominent than primaries.

*Racemes* terminal, shorter than leaves, few flowered, the rachis rather stout, 4-angled; *flowers* solitary on pedicels up to c. 1.5 cm. long, fragrant, 7–8 cm. across stamens; *calyx* tube pale greenish or pale yellowish, obconic, c. 1.5 cm. long, c. 1 cm. across mouth (excluding lobes), narrowed to base and slightly contracted into a stout not well defined pseudostalk 2–3 mm. long; lobes 4, persistent, reflexed after anthesis, broadly ovate rounded, somewhat unequal, the 2 larger c. 1 cm. across at base and 6 mm. tall; *petals* 4, white, reflexed after anthesis, orbicular, concave, gland dotted, c. 1.5 cm. diam; *stamens* numerous, filaments slender, terete, up to c. 4 cm. long, cream white, anthers oblong, c. 1.2 mm. long, connective gland small and inconspicuous; *style* stouter than filaments, subulate, c. 3.5–4 cm. long; *ovary* 2-celled, multiovulate.

*Fruit* very depressed globose, up to c. 6 cm. diam., 3–4 cm. tall, distinctly rose scented, pale orange yellow or greenish yellow tinged pink and flushed pink on one side, surface dull, closely gland dotted; apical umbilicus c. 1–1.75 cm. diam., with the 4 thickened slightly incurved greenish calyx lobes, and style remains; pericarp firm, slightly juicy, pale orange yellow, sweet and slightly astringent, with strong taste of rose water, 1 cm. thick or more; seed 1, lying loosely in centre, depressed globose, c. 2.5 cm. diam., testa thick, brown or white, pithy, closely adhering to the rugose surface of the cotyledons.

13. *Eugenia plumbea* King, Mat. F.M.P., No. 12, 85 (1901); Ridl., F.M.P., I, 727. (Fig. 12c).

PERAK: Gunong Batu Puteh, 3,400 feet, Wray 479 (type collection).

*Distrib.*: Endemic.

So far known only from one collection.

*A tree.* *Twigs* slender, 4-angled, bark dark. *Leaves* thinly coriaceous, lanceolate, acuminate, base cuneate, up to

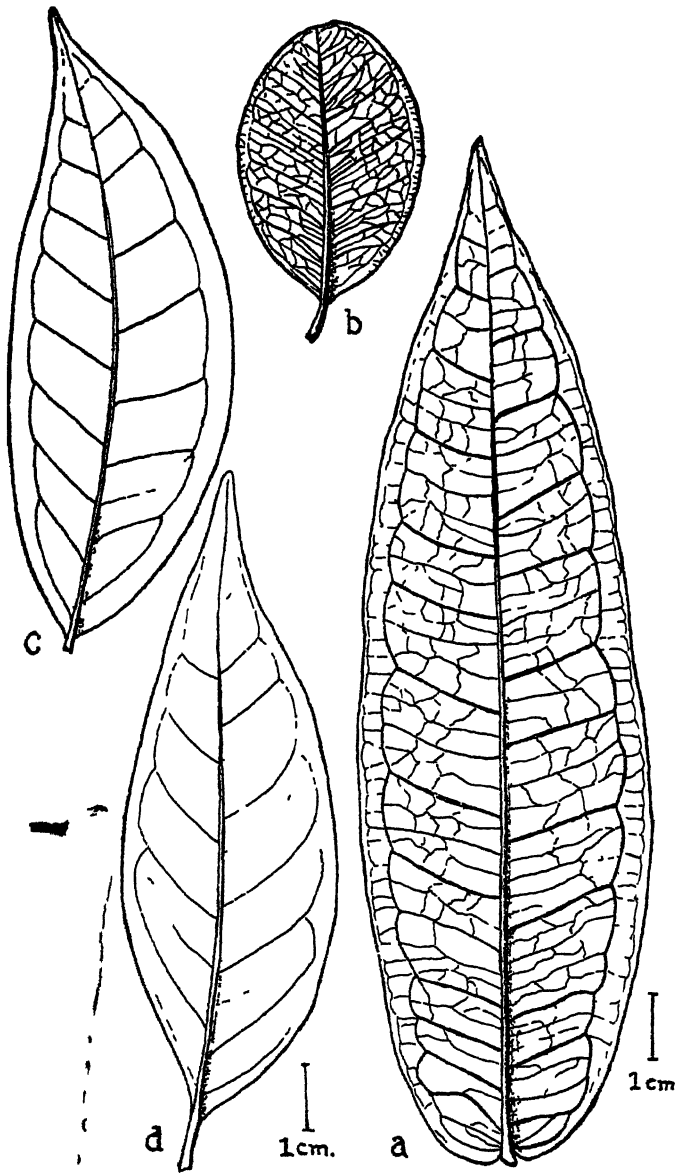


Fig. 12. a, *E. porphyranthera*; b, *E. oreophila*; c, *E. plumbea*; d, *E. Rostadonis*.

c. 10 cm.  $\times$  3.5 cm., both surfaces lead colour when dry, the upper shining, the lower dull; *primary nerves* up to 10–12 pairs, impressed above, prominent below, c. 0.5–1 cm. apart, ascending and running straight to a conspicuous intramarginal nerve c. 5 mm. from leaf margin, with a much fainter loop very close to the margin; petiole very short, up to c. 3 mm. long.

*Inflorescences* terminal or axillary, of shortly pedunculate racemes bearing about 3 flowers. Flowers distinctly pedicellate; *calyx* campanulate, c. 1.6 cm. long, rounded at base; lobes 4, broad and rounded, 4–5 mm. tall; *petals* rotund-reniform, larger than calyx lobes but shorter than stamens. Flowers, including stamens, delicate green (fide Wray). *Fruit* unknown.

14. *Eugenia Rostadonis* Ridl. in Journ. Roy. As. Soc. Str. Br., LXI, 8 (1912); F.M.P., I, 727. (Fig. 12d).

TRENGGANU: Bundi, *Rostados* s.n. (type collection).

*Distrib*: Endemic.

? A tree. *Twigs* slender, terete, with smooth brownish bark. *Leaves* thinly coriaceous, lanceolate, up to 10.5 cm.  $\times$  3.5 cm., apex acuminate, base cuneate, midrib impressed above in a narrow channel, elevate below; *primary nerves* 6–8 pairs, impressed and obscure above, slender and raised below, c. 1 cm. apart, meeting in a looped intramarginal nerve 2–4 mm. from leaf margin, with another very obscure loop very close to the margin; secondaries and reticulations invisible above, secondaries below very few, reticulations lax, very slender; upper surface drying reddish black, closely and finely punctate, lower surface pale with numerous minute raised darker glands; petiole slender, up to c. 1 cm. long.

*Inflorescences* terminal or from upper leaf axils, of short cymes of 2–? 5 flowers, peduncle c. 2 mm. long with a pair of small persistent triangular acute bracts c. 1 mm. long; pedicels 3–4 mm. long with a pair of similar bracteoles; *calyx* tube c. 1.2 cm. long, campanulate or funnel shaped, narrowed to a short stout pseudostalk; lobes broadly ovate orbicular, c. 7 mm. wide and 5 mm. tall, apparently more or less persistent; *petals* white (fide Ridley); *stamens* numerous, slender, over 1 cm. long; *style* c. 3.5 cm. long. *Fruit* unknown.

Although only one collection is known of this species, it appears distinct in the lax habit, the leaves drying dark above and pale below, and in the very short, usually terminal

inflorescences with persistent bracts and bracteoles. It is allied to *E. porphyranthera* Ridl. and *E. plumbea* King, but very distinct from both in foliage characters.

15. *Eugenia Scortechinii* King, Mat. F.M.P., No. 12, 85 (1901), incl. var. *parvifolia* King; Ridl., F.M.P., I, 725. (Fig. 11c).

Not uncommon from Penang to Johore on the west side of the Main Range, in lowland forest. There is one doubtful collection from Singapore, *SFN 5974* (*Burkill*), in which the twigs are rounded.

*Distrib*: Lower Siam.

A tree up to c. 16 metres tall or a shrub. Youngest twigs strongly 4-angled, winged below nodes, bark smooth and brown, older twigs terete with greyish or brownish bark. Leaves lanceolate, ovate lanceolate or ovate oblong, apex acute or acuminate, narrowed to a rounded, more or less cordate base, upper surface drying dark brown to almost black, closely and minutely punctate, lower surface paler, reddish or reddish brown, without visible glands; midrib narrowly impressed above, prominent below; primary nerves up to c. 10 pairs, usually c. 1 cm. apart, impressed above, prominent below, ascending and curving gently up to a conspicuous intramarginal nerve c. 5 mm. from leaf margin, with a very faint loop nearer the margin; secondaries and reticulations very faint or invisible above, visible below but faint; petiole 2-3 mm. long.

Inflorescences terminal or from upper axils, very short, almost sessile, rachis c. 1 cm. long or less, flowers up to c. 9, sessile or pedicellate, red with yellow centre; calyx widely campanulate, 1-1.4 cm. long, abruptly contracted at base into a stout pseudostalk c. 3-4 mm. long, lobes 4, persistent, unequal, broadly ovate rounded, the larger c. 7 mm. across at base and 5 mm. tall; petals 4, free, red (fide King), orbicular, thick textured with thin margins, c. 10 mm. diam.; stamens numerous, 1 cm. or more long, filaments slender, subulate, anthers oblong, c. 1.5 mm. long, no connective gland visible; style slender, c. 3.5 cm. long; ovary 2-locular multiovulate. Fruit (probably unripe) oblong globose, c. 2 cm. diam., the whole of the apex deeply excavate, fringed with the very short remains of the calyx tube and the hardly enlarged calyx lobes; seeds apparently 2, cotyledons stalked, inner faces folded and excavate, hypocotyle long but not reaching outer surface of seed.

**E. Scortechinii King var. cuneata var. nov.**

A *typa* foliis basi cuneatis, petiolatis, ramulis plus minusve teretis vel leviter sulcatis differt.

TRENGGANU: Ulu Brang, 1,000 feet, *SFN 33661* (*Moysey & Kiah*).

NEGRI SEMBILAN: Sungai Ujong, *Alvins s.n.*, 3329.

SELANGOR: Batu Caves, *Forest Dept. FMS 30791*; Labu river, *Ridley s.n.*

PAHANG. Sungai Cheka, Kuala Lipis, *Forest Dept. FMS 4028*.  
TYPE collection, holotype in Herb. Singapore.

JOHORE: Kuala Sembrong, *Lake & Kelsall s.n.*

*Distrib:* Endemic.

16. *Eugenia diospyrifolia* Duthie in Hook. fl., F.B.I., II, 472 (1878). *E. diospyrifolia* Wall. nom. nud. *E. nemoricola* Ridl. in Journ. Roy. As. Soc. Str. Br., LXI, 9 (1912); F. M. P., I, 725, sub *E. pseudiformosa* King. (Fig. 13a).

KEDAH: Koh Mai Forest Reserve, *SFN 35207* (*Kiah*); Langkawi, *Haniff s.n.*

KEMAMAN: Bukit Kajang, *Corner s.n.* (leaves only).

PENANG: Richmond Pool, *Ridley s.n.*; Government Hill, 2,400 feet, *Curtis s.n.*; Telok Bahang, *SFN 12685* (*Haniff*).

PAHANG: Kuala Teku, 500 feet, *Seimund 438, 538*.

*Distrib:* Assam, Burma, Siam, Sumatra.

A small tree. *Branchlets* terete or more or less compressed, smooth, bark brownish or greyish. *Leaves* oblong, lanceolate or narrowly ovate, up to c. 26 cm.  $\times$  7 cm., but variable in shape and size, apex acuminate, base slightly narrowed or truncate, or rounded and more or less cordate, upper surface drying brown to black, minutely punctate, lower surface paler with dark gland dots; midrib more or less impressed above, prominent below; *primary nerves* up to c. 15 pairs in largest leaves, 1–3 cm. apart, impressed above and often very inconspicuous, slender but prominent below, ascending and curving gently up to a well marked shallowly looped intramarginal nerve c. 0.5–1 cm. from leaf margin, with a much fainter loop much nearer the margin usually visible; secondaries and reticulations usually faint or obscure above, fine and slightly raised below; petiole short and stout, 5 mm. or less long.

*Inflorescence* few flowered, terminal, short, usually on a peduncle of variable length, but whole inflorescence not more than c. 4 cm. long; *calyx* up to c. 2 cm. long on a pedicel up to c. 2 cm. long, widely campanulate, narrowed rather abruptly at base to a pseudostalk which may reach almost 1 cm. but is usually shorter, bracts and bracteoles

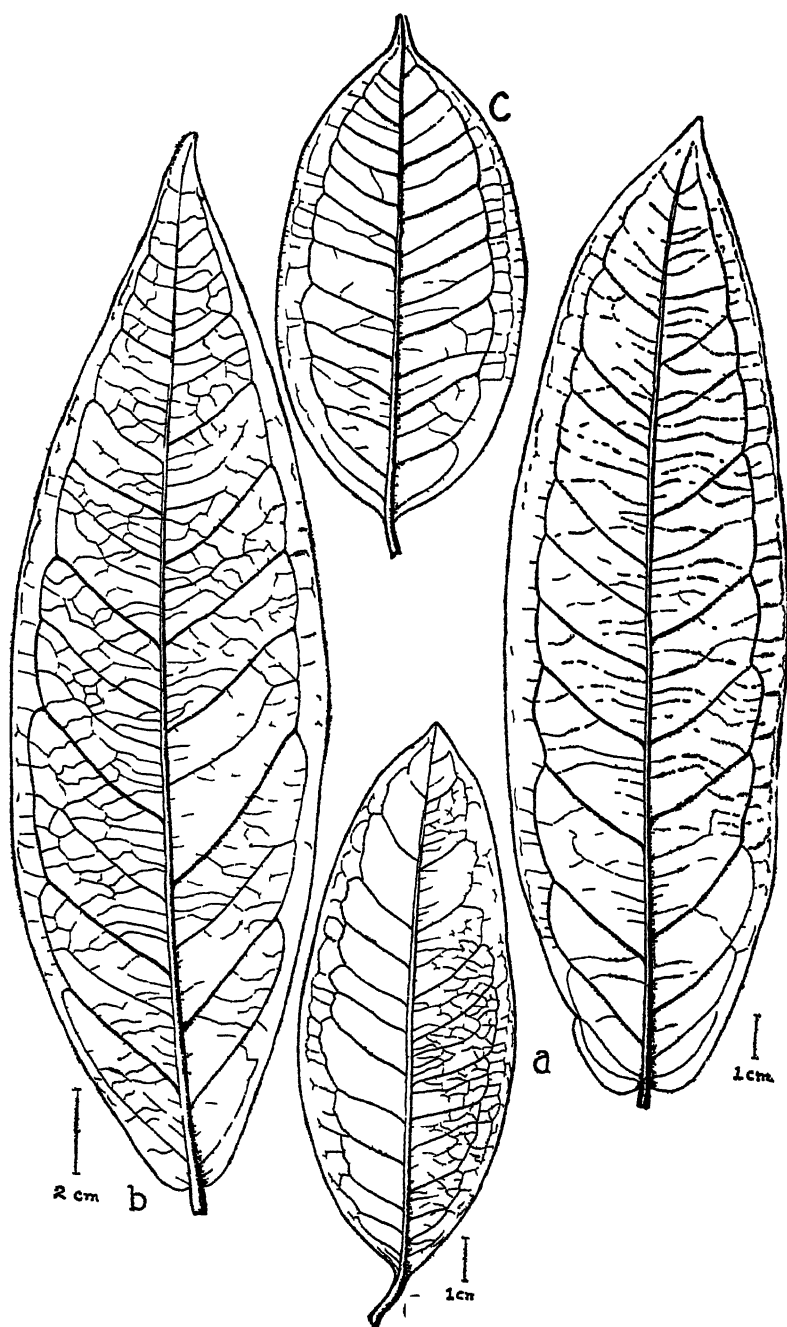


Fig. 18. a, *E. diospyrifolia*; b, *E. pseudoformosa*; c, *E. johorensis*; d, *E. densiflora*.

minute, narrowly ovate, subpersistent, lobes 4, more or less unequal, broadly ovate rounded, the largest nearly 1 cm. across at base and 5 mm. tall; *petals* 4, free, orbicular, glandular pustulate, c. 1 cm. diam.; *stamens* numerous, c. 2 cm. long, filaments very slender, subulate, anthers oblong, c. 1 mm. long, connective gland apparently none; *style* very slender, c. 4 cm. long; *ovary* 2-celled, multiovulate. *Fruit* (probably unripe) very like that of *E. Scortechinii*, but with a more pronounced apical calyx tube.

The plants included here vary greatly in size of leaf. Part may be *E. diospyrifolia* var. *lanceolata* (Korth.) Craib, which I have not seen. Seimund's collections from Kuala Teku have very small oblong lanceolate leaves and may be a riverside variety. The species appears to be a variable one in foliage characters, judging from specimens in Herb. Calcutta named by King and from a long series of specimens included here in Herb. Dehra Dun.

17. *Eugenia pseudoformosa* King, Mat. F.M.P., No. 12, 83 (1901); Ridl., F.M.P., I, 725, pro parte; *E. formosa* King, loc. cit. 80, non Wall. *Syzygium pseudoformosum* (King) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 165 (1939) pro parte. (Fig. 13b).

In lowland forest from Perak and S. Trengganu to Singapore, once recorded from Perak at 3,000–4,000 feet.

*Distrib*: Lower Siam, Borneo, ? Java.

A *shrub* or small *tree*, bark thin smooth entire, silvery grey, green below surface; wood pale yellowish turning dingy on exposure. *Branchlets* terete, slightly compressed at nodes, bark usually pale. *Leaves* elliptic or oblong elliptic, up to 30 cm. or even more long, and 12–13 cm. broad, apex acuminate, base narrowed, rounded and more or less cordate; upper surface drying olivaceous brown to dark brown, very minutely gland dotted or glandular pustulate, lower surface paler, usually yellowish brown, not visibly glandular; midrib impressed above, prominent below; *primary nerves* up to about 20 pairs, usually c. 14, more or less impressed above, elevate below, widely spaced, ascending, nearly straight or curving gently up to a prominent looped intramarginal nerve 0.5–1 cm. from leaf margin, with a much fainter intramarginal nearer the margin; secondaries few; reticulations lax, distinct below, but much less prominent than primaries; petiole short, c. 0.5 cm. long, thick and corky, drying pale.

*Inflorescences* terminal, of very shortly peduncled cymes, or the flowers fascicled and rather densely crowded. *Flowers* sessile or nearly so, pink except for white margin of petals; *calyx* narrowly campanulate, glandular pustulate, up to c. 1.8 cm. long and 1 cm. across mouth before anthesis,

the base narrowed rather abruptly into a stout conical pseudostalk which is variable in length but may reach c. 6 mm.; lobes 4, broad and rounded, the outer smaller, more or less triangular, the largest nearly 1 cm. across at base and 6-7 mm. tall; *petals* 4, free, broadly obovate-orbicular, gland dotted, c. 1 cm. diam.; *stamens* up to c. 3.5 cm. long, filaments slender, broadened at base, anthers oblong, c. 2.1 mm. long, connective gland not visible; *style* slender, c. 4 cm. long; *ovary* 2-locular, multiovulate. *Fruit* similar to that of *E. Scortechinii*, oblong globose, narrowed at base, the whole apex deeply excavate with the calyx lobes persisting for some time.

Merrill and Perry include here *E. formosa* Koord. and Valet. in Meded. Lands Plantent., XL, 73 (1900); Atlas Baumart. Java, III, figs. 459, 460, but although what Koorders and Valetton describe can hardly be *E. formosa* Wall., I am a little doubtful as to whether it can be included in *E. pseudoformosa* King. The flower buds as figured by Koorders and Valetton are rather different in shape from those of the Malay Peninsular material, the calyx tube being much less narrowed at the base. They are more like the buds of *E. diospyrifolia* but the swollen corky petiole, which is characteristic of *E. pseudoformosa*, and which Koorders and Valetton figure, is not present in *E. diospyrifolia*.

18. *Eugenia tiumanensis* Ridl. In Trans. Linn. Soc., III, 299 (1893); F.M.P., I, 725. (Fig. 14c).

PAHANG: Pulau Tioman, Ridley (not seen); Joara Bay, Pulau Tioman, SFN 1043 (Burkill)?

"A big tree. Branches slender. Leaves thin, narrow lanceolate acuminate, 4 in. long, 1 in. wide; petioles 1 in. long, slender. Flowers sessile in a terminal head, white. Calyx campanulate; lobes large round 0.5 in. long. Petals short, oblong, round. Stamens 0.5 in. long."—ex Ridley.

This species was described by Ridley from specimens collected by himself in rocky jungle in Pulau Tioman, but no number was quoted in the description. No type specimen, or any specimen written up by Ridley, or collected by him and corresponding to his description can be discovered in the Herbaria at Kew and Singapore, although such specimens, if they exist, should be in Singapore.

Burkill's collection fits the description as far as it goes, except that Ridley describes his plant as a large tree, and Burkill's field note reads "small tree, 15 ft."

If SFN 1043 is correctly placed, then *E. tiumanensis* comes very near to *E. Scortechinii* var. *cuneata* and may be only an extreme form of it, but the leaves are much

narrower and much more narrowed to apex and base, the petioles are longer and there are slight differences in the venation.

*E. pseudoformosa*, *E. Scortechinii*, *E. diospyrifolia*, and *E. tiumanensis* are difficult to define in a satisfactory manner, and this appears to be the experience of most botanists who have worked on these and related species. The obscure status of *E. tiumanensis* adds to the difficulty. The following are the main distinguishing points between the four species:—

- E. pseudoformosa*—Inflorescence and flowers more or less sessile; twigs rounded; leaves broadest about middle, usually large (c. 20 cm. long), base rounded or subcordate.
- E. diospyrifolia*—Inflorescence peduncled, flowers pedicelled; twigs more or less rounded or compressed or more or less 4-angled; leaves usually broadest near base, base truncate, rounded or subcordate.
- E. Scortechinii*—Inflorescence and flowers more or less sessile; twigs strongly angled to winged; leaves broadest about middle (c. 15 cm. long or less), base rounded or subcordate, nearly sessile.
- E. Scortechinii* var. *cuneata*—Inflorescence and flowers more or less sessile; twigs rounded or slightly angled; leaves broadest about middle (15 cm. long or less), base cuneate, petiolate.
- E. tiumanensis*—Inflorescence and flowers more or less sessile; twigs rounded; leaves narrow lanceolate, long narrowed to apex and base, petiolate.

19. *Eugenia pendens* Duthie in Hook. fil., F.B.I., II, 475 (1878); King, Mat. F.M.P., No. 12, 94; Ridl., F.M.P., I, 726. (Fig. 14a).

An endemic species not uncommon in lowland forest from Perak and Kelantan to Singapore.

A small tree. Twigs slender, terete, more or less compressed at nodes, smooth, bark brownish. Leaves thinly coriaceous, elliptic, oblong elliptic to ovate lanceolate, up to c. 22 cm.  $\times$  9 cm., but usually smaller, apex acuminate, sometimes abruptly, acumen blunt or acute, base cuneate; upper surface drying olivaceous or brownish, minutely punctate, lower surface greenish, gland dotted; midrib shallowly impressed above, prominent below; primary nerves 10–15 pairs, usually c. 1 cm. apart, impressed above,

elevate below and rather slender, ascending and curving to a looped intramarginal nerve 4-6 mm. from leaf margin, with another very fine loop nearer the margin; reticulations very fine above and raised, visible only under a lens, fine, raised and lax below; petiole up to c. 1 cm. long.

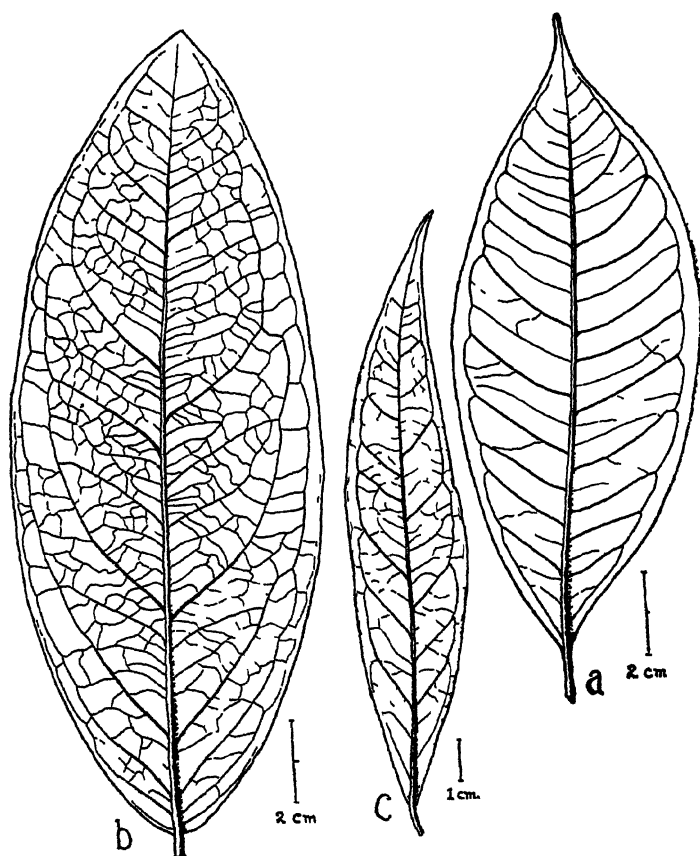


Fig 14. a, *E. pendens*; b, *E. javanica*; c, *E. ? trumanensis* (SFN 1043).

*Inflorescences* terminal or occasionally axillary, on a variable peduncle up to c. 1 cm. long, the inflorescence rachis not more than about 2 cm. long. *Flowers* about 5-6 on very variable bright green pedicels up to c. 25 cm. long; *calyx* funnel shaped or more or less campanulate, c. 1 cm. long, the tube very pale yellow flushed pink, the lobes pale greenish yellow flushed pink, narrowed at base and rather

abruptly contracted into a pseudostalk varying from 3–4 mm. to almost none; lobes 4, persistent, spreading, unequal, very broad, the larger c. 1 cm. across and 4–5 mm. tall; *petals* 4, free, quickly deciduous, gland dotted, orbicular, c. 1 cm. diam.; *stamens* numerous, up to 1.3 cm. long, filaments slender, anthers less than 1 mm. long, connective gland very inconspicuous; *style* stouter than filaments and about equal to them in length. *Fruit* depressed globose, green flushed red (?unripe), c. 2.5 cm. diam., with obscure vertical ridges when dry, apical excavation wide and shallow, c. 1.2 cm. diam., fringed by the very short calyx tube and persistent reflexed calyx lobes.

Many specimens have been wrongly accredited to this species in Herb. Singapore. In Herb. Kew is a sheet of *Scortechini 2021* determined as this species by King and later queried in an unknown hand. It is *E. virens* Koord. and Valet. Perhaps this sheet is the basis of King's remark in the "Materials" that *E. pendens* is allied to *E. densiflora*, for *E. virens* is much more similar, superficially, to *E. densiflora* than to *E. pendens*.

20. *Eugenia johorensis* Ridl. in Journ. Roy. As. Soc. Str. Br., LXI, 8 (1912); F.M.P., I, 725. (Fig. 13c).

JOHORE: Gunong Pulai, *Ridley's collector s.n.*, dated 1892 (type collection).

A tree (fide Ridley). Older *twigs* terete with brown flaky bark, youngest parts 4-angled with narrow wings on the angles, smooth. *Leaves* elliptic or elliptic oblong, up to c. 13 cm. long and 5.5 cm. broad, apex shortly acuminate, acute, base broadly cuneate-rounded, abruptly narrowed on to the petiole; petiole 1 cm. long or a little less; midrib lightly impressed above, elevate below; *primary nerves* 8 or 9 pairs, 1 cm. apart, faint and slightly raised above, elevate below, slender but bold, meeting in a shallowly looped intramarginal nerve 5–8 mm. from leaf margin with a much finer intramarginal 1.5–2 mm. from margin; secondaries and reticulations faint and slightly raised above, the secondaries below almost as conspicuous as the primaries, the reticulations fainter; both surfaces drying brownish, not gland dotted.

*Flowers* terminal (?or also from upper leaf axils), in pairs, on very short pedicels c. 3 mm. long, apparently bearing minute subpersistent bracts and bracteoles; *calyx* tube, including pseudostalk, c. 2 cm. long, broadly campanulate and abruptly narrowed to a slender pseudostalk 6–8 mm. long: lobes broad, rounded, unequal, ?subpersistent; *petals* large, rounded; *stamens* numerous, c. 2 cm. long; *style* c. 2.5 cm. long. *Fruit* unknown.

Only one sheet is known of this species. It bears two mature flowers and two buds. It seems curious that this species, which must be a conspicuous one with its large flowers, has never been met with again.

21. *Eugenia javanica* Lamk., *Encycl.*, III, 200 (1789); Duthie in Hook. fil., *F.B.I.*, II, 474; King, *Mat. F.M.P.*, No. 12, 81; Gagnep. in *Fl. Gen. Indo-Ch.*, II, 837; Koord. & Valet., *Atlas Baumart. Java*, III, fig. 452; Ridl., *F.M.P.*, I, 726; Corner, *Wayside Trees of Malaya*, p. 499. *Myrtus samarangensis* Bl., *Bijdr.*, 1084 (1826). *Syzygium samarangense* (Bl.) Merr. & Perry in *Journ. Arn. Arb.*, XIX, 115 (1938). (Fig. 14b).

Wild usually near the sea and cultivated in a number of varieties. Some of the Malay names are: *Jambu Ayer*, *Jambu Puteh*, *Jambu Ayer Mawar*, *Jambu Ayer Rhio*, *Jambu Ayer Patah Raja*.

*Distrib*: Lower Burma, Andamans, Nicobars, to Java.

A small to medium sized *tree*, massive when old. *Twigs* rather slender, terete, the youngest green the older with smooth brown bark. *Leaves* coriaceous or thinly coriaceous, broadly oblong, elliptic oblong, elliptic lanceolate or elliptic, occasionally narrowly ovate, apex acute or subacute, base slightly narrowed, rounded and sometimes slightly cordate, up to c. 25 cm.  $\times$  10 cm., but variable in size, rather dull dark green above, paler below, usually drying pale reddish brown, in life with minute scattered pellucid gland dots, often black dotted below when dry; midrib channelled above, elevate and rather broad below; *primary nerves* up to c. 12 pairs, spreading-ascending, raised on both surfaces but not very prominent, sometimes channelled above when dry, meeting in a looped intramarginal nerve c. 5–10 mm. from margin with another series of fainter loops nearer the margin; secondaries and reticulations rather obscure in life, distinct when dry but less prominent than primaries; petiole 5 mm. or less long.

*Inflorescences* axillary or terminal, 5–10 cm. long and broad, on peduncles up to c. 3 cm. long, or almost sessile; *flowers* white, in threes, twos or solitary at the ends of the two or three pairs of slender, spreading, distant branches up to c. 3 cm. long, the rachis and branches green; flowers sessile or on pedicels up to c. 1 cm. long; *calyx* pale green, obovoid, c. 1.4–1.5 cm. long, c. 1.5 cm. across, narrowed at base into a short stout pseudostalk; lobes 4, somewhat unequal, transversely oblong, rounded, concave, c. 1 cm. across at base and 4–5 mm. tall, persistent; *petals* 4, white with inconspicuous brownish gland dots, obovate orbicular,

shortly and broadly clawed, c. 1.2–1.5 cm. long; *stamens* numerous, filaments white or pale greenish white, slender, terete, the longest up to c. 2.5 cm., anthers oblong, c. 1.5 mm. long, connective gland small and inconspicuous; *style* stouter than filaments, c. 3 cm. long; *ovary* 2-celled, multiovulate.

*Fruit* greenish or whitish or red when ripe, shining and of a waxy appearance, slightly ribbed, broadly obconic or pyriform or somewhat turbinate, usually c. 4–6 cm. long and broad, but often much larger in cultivation, apex widely excavate, bearing the much enlarged, fleshy, incurved calyx lobes; pericarp very thick, white, spongy, slightly juicy, seeds 1–2 lying loosely in a cavity in the centre, irregularly globose or hemispherical, 1.2–1.5 cm. diam., testa white, thick and pithy, adhering closely to cotyledons; structure of cotyledons very similar to that of *E. malaccensis* and *E. aquea*.

22. *Eugenia pseudomollis* nom. nov.

*E. mollis* King, Mat. F.M.P., No. 12, 86 (1901); Ridl., F.M.P., I, 728; non Willd. ex Berg. (1854). (Fig. 15a).

PERAK: Larut, within 300 feet, *Kunstler* 2686, 2808 (syntypes), within 100 feet, *Kunstler* 5572 (syntype); Taiping, *Wray* 2372 (syntype), within 100 feet, *Kunstler* 8387 (syntype).

*Distrib*: Sumatra.

A small tree or shrub. *Twigs* slender, slightly 4-angled or terete and compressed at nodes, pale brown, bark faintly papillate, with a covering of very short coarse brown hairs. *Leaves* thinly coriaceous, oblong lanceolate, apex acuminate to a narrow acute acumen, base slightly narrowed, rounded and subcordate, up to c. 28 cm.  $\times$  6.5 cm., upper surface drying olivaceous brown, minutely punctate, glabrous, lower surface darker, minutely and closely glandular pustulate, clothed with short stiff coarse brown hairs; midrib impressed above, prominent below and rounded; *primary nerves* 25–30 pairs, fine and slightly raised above, slender but prominent below, 1–2 cm. apart, ascending and running straight or very slightly curved to a very shallowly looped intramarginal nerve c. 3–5 mm. from leaf margin; secondaries and reticulations very fine and almost invisible above, except under a lens, slightly more pronounced below, the few secondaries fairly distinct, sometimes almost as prominent as primaries; petiole stout, 3–5 mm. long.

*Inflorescences* in lax terminal panicles up to c. 21 cm. long, peduncle up to c. 5 cm., compressed and obscurely 4-angled like the branchlets of the inflorescence and covered with the same coarse indumentum as the twigs and under surfaces of the leaves; branchlets in distant pairs, c. 5–6 cm. apart, the lower pair almost horizontal, c. 5–6 cm. long, the

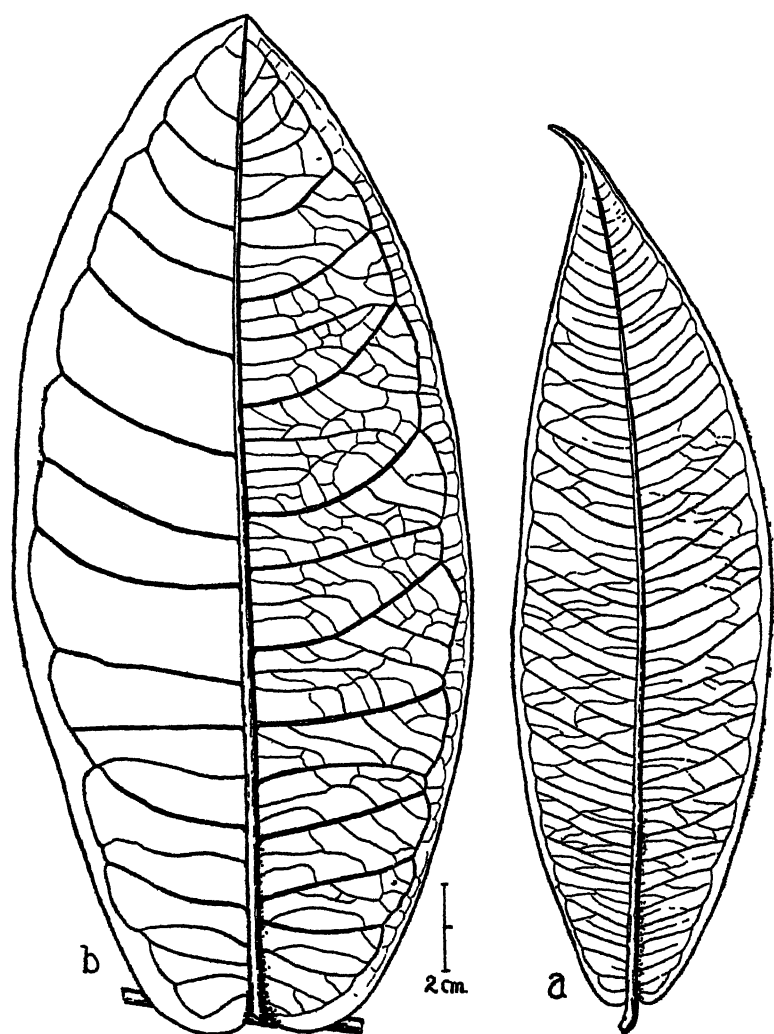


Fig. 15. a, *E. pseudomollis*; b, *E. papillosa*.

upper two pairs shorter and more ascending; *flowers* numerous, not crowded, usually in threes at the ends of short secondary or tertiary branchlets, these branchlets often subtended by a solitary flower or a pair of flowers; flowers white (fide Wray and Kunstler); pedicel variable, from 1–5 mm.; *calyx* c. 1 cm. long, the tube scurfy, funnel shaped, tapering quickly from below lobes to a short rather obscure pseudostalk c. 1.5 mm. long; lobes 4, unequal, broadly ovate rounded, the largest c. 4 mm. across and

3 mm. tall; *petals* 4, free, orbicular, c. 7–8 mm. diam., gland dotted; *stamens* numerous; *ovary* 2-celled, multiovulate. *Fruit* (ex King) ovoid globose, c. 1.5 cm. diam., crowned by the cupular calyx and covered with deciduous scurf-like hairs.

A species easily recognised by the short thick brown hairs on the branches and undersurfaces of the leaves, and the scurfy indumentum of the inflorescence and calyx tube.

23. *Eugenia papillosa* Duthie in Hook. fil., F.B.I., II, 495 (1878); King, Mat. F.M.P., No. 12, 84; Ridley, F.M.P., I, 730; Corner, Wayside Trees of Malaya, p. 501; *Syzygium papillosum* (Duthie) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 157 (1939). (Fig. 15b).

Not uncommon in lowland forest, often in fresh water swamp forest, from Perak to Singapore.

*Distrib.*: Borneo.

A tall tree, base of trunk often with strongly arcuate and branched stilt roots; bark thickly papery flaky, bright orange rufous, bright green immediately below surface even in oldest trunks; inner bark pallid. *Branchlets* stout, terete, brown to dark brown, the youngest scurfy. *Leaves*: coriaceous, obovate oblong, or elliptic oblong, or oblong lanceolate, up to c. 35 cm.  $\times$  15 cm., apex subacute or blunt, base slightly narrowed, cordate auriculate, subamplexicaul; upper surface drying blackish brown, smooth, not, or very sparsely punctate, lower surface brownish or reddish, glandular, sparsely scurfy when young; midrib impressed above, prominent and rounded below; *primary nerves* up to about 20 pairs, impressed or slightly raised above and very slender, very prominent below, 1–3 cm. apart, arising almost at right angles to the midrib and curving up to a prominent looped intramarginal nerve c. 3–10 mm. from leaf margin, a much fainter loop much nearer and usually hidden by the strongly recurved margin; reticulations faint or obscure above, lax and well marked below but much less prominent than primaries; petiole very short and thick, the leaves appearing sessile.

*Inflorescences* paniced, several together, terminal or from the upper axils, shorter than leaves, reaching 15–18 cm., but variable in length; peduncles, rachis and branchlets rather stout but thinner than twigs, more or less compressed, scurfy like the vegetative branchlets; branchlets ascending or divaricate; *flowers* sessile, fragrant, yellowish green or almost white, crowded in bracteate heads at the ends of the short ultimate branchlets, each flower subtended by two subsistent lanceolate bracts c. 5 mm. long, with broader ovate bracts at the base of the head; *calyx* c. 1 cm.

long, funnel shaped or narrowly campanulate, slightly constricted below lobes, narrowed to a rather stout pseudostalk c. 5 mm. long, lobes 4, unequal, broadly triangular, blunt, c. 2-3 mm. tall, reflexed after anthesis; *petals* 4, free, quickly deciduous, orbicular, shortly clawed, conspicuously veined, c. 6-7 mm. diam.; *stamens* numerous, up to c. 1.6 cm. long, filaments slender, subulate, anther oblong elliptic, less than 1 mm. long, with a brownish connective gland; *style* stouter than filaments, c. 1.3 cm. long; *ovary* 2-celled. *Fruit* globular, c. 2.5 cm. diam., pale green.

A conspicuous and well marked species of lowland swampy forest, with its orange papery flaky bark, large almost sessile amplexicaul leaves and bracteate heads of flowers.

24. *Eugenia densiflora* (Bl.) Miquel, Anal. Bot. Ind., I, 17 (1850); DC., Prodr. III, 287 (1828) in syn.; Duthie in Hook. fil., F.B.I., II, 473; King, Mat. F.M.P., No. 12, 84; Ridl., F.M.P., I, 728; Koord. & Valet., Atlas Baumart. Java, III, figs. 446, 447; Corner, Wayside Trees of Malaya, p. 497, fig. 168. *Myrtus densiflora* Bl., Bijdr., 1087 (1826). *Jambosa densiflora* DC., Prodr., III, 287 (1828) [De Candolle here publishes in synonymy "*Eugenia densiflora* Bl." Whether this is to be regarded as an alternative name or whether it has no nomenclatorial standing is not clear. De Candolle does not quote *Myrtus densiflora* Bl., but he does give the page reference to the Bijdragen. It would appear that Miquel's is the earliest valid transfer to *Eugenia*]. *Syzygium pycnanthum* Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 168 (1939). (Fig. 13d).

Common in lowland forest and on seashores from Penang and Trengganu to Singapore, and once recorded from forest at 3,000 feet in Perak.

*Distrib*: Siam, Sumatra, Borneo, Java.

A tree up to c. 16 metres tall, or *shrubby*. *Bark* rather variable; trees in open—bark scaly in large thin angular pieces, not fissured or rugose, greyish pinkish brown, dark, inner bark pale pinkish brownish; trees in shade—bark smooth, entire, pinkish greyish, pale; young trees—bark thinly and finely papery flaky, scaling in small pieces, pale greyish white; inner bark green immediately below surface, then pinkish. *Branchlets* stout, terete or slightly compressed, with reddish or brownish striate or rather flaky bark. *Leaves* coriaceous, rather variable in shape and size, usually elliptic oblong, or ovate oblong or even lanceolate, up to c. 28 cm.  $\times$  10 cm., apex acuminate, base cuneate or broad and narrowed abruptly to the petiole,

upper surface drying olivaceous, brown or reddish brown, usually closely and minutely punctate or glandular pustulate, lower surface pale brown or reddish brown, more or less black gland dotted; midrib impressed above, prominent and rounded below; *primary nerves* up to c. 20 pairs, usually 1–2 cm. apart, slender but raised and distinct on both surfaces, ascending and curving gently up to a distinct looped intramarginal nerve which is sometimes as much as 2 cm. from leaf margin but more usually 7–10 mm., with a slightly less marked but still distinct series of loops 3–4 mm. from margin, and a third faint series very close to the margin; in some leaves there may be 4 intramarginal veins, but the two inner ones are nearly always present and distinct; secondaries and reticulations raised on both surfaces, distinct, but less prominent than primaries and easily distinguishable from them; petiole usually rather stout, wrinkled, up to c. 1 cm. long.

*Panicles* terminal, short and dense, up to c. 15 cm. across, usually almost sessile, but sometimes on peduncles c. 2 cm. long, much branched, the branchlets stout, more or less compressed, with wrinkled or striate brown or reddish bark; *flowers* sessile or shortly pedicellate, white or rose pink, up to c. 5 cm. across when expanded; *calyx* c. 1.5 cm. long, tube funnel shaped, tapered from below lobes, striate when dry, slightly narrowed at base into an obscure pseudostalk 1–2 mm. long; lobes 4, unequal, broad and rounded, the two inner larger with thin margins, c. 8–10 mm. across and 5–7 mm. tall; *petals* 4, free, orbicular with broad base, c. 1.5 cm. diam., gland dotted; *stamens* numerous, up to c. 5 cm. long, filaments slender, flattened below, subulate above, anthers oblong, c. 1.5 mm. long, connective gland not visible; *style* c. 5 cm. long, a little stouter than filaments; *ovary* 2-celled, multiovulate. *Fruit* globose, c. 2–3 cm. diam., pinkish to purple, apical excavation shallow, c. 0.5–1 cm. diam., fringed with the persistent enlarged erect sepals.

- E. densiflora* Miq., var. *angustifolia* Ridl., F.M.P., I, 729 (1922); Corner, Wayside Trees of Malaya, p. 497. *E. Foxworthyi* Ridl., F.M.P., I, 728 (1922) non Elmer (1912). *E. Foxworthiana* Ridl., F.M.P., V (Suppl.), 308 (1925). *Syzygium Foxworthianum* (Ridl.) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 168 (1939).

Common on riverbanks in the lowlands in Patani, Upper Perak, Kelantan and Pahang.

*Distrib*: Lower Siam, Borneo, Java (fide Ridley).

Differs from the typical form in being a bushy small tree of river banks, with smaller narrower leaves with the

venation less prominent, especially above, with usually only one intramarginal nerve which is much closer to the leaf margin; and in the laxer inflorescence with usually long pedicelled flowers.

*Fruit* globular or more or less depressed globular, 1.5–2 cm. diam., crowned by the erect very conspicuous calyx lobes as much as 6 mm. high; pericarp fleshy, soft, 3–5 mm. thick, inner layer fibrous; seed c. 1 cm. diam., testa rather thin, closely adhering to the cotyledons; cotyledons side by side or oblique, dark coloured, slightly unequal, hypocotyle nearly central, plumule rather large and conspicuous, cotyledons sessile, the inner faces nearly plane except for a ridge and depression to one side of the plumule.

25. *Eugenia rhomboidea* Ridl. in Journ. F.M.S. Mus., V, 33 (1913–14); F.M.P., I, 753. (Fig. 16a, b, c).

SELANGOR: Gunong Mengkuang, 5,000 feet, Robinson s.n. (type collection).

Leaf specimens collected on the summit of Gunong Belumut, Johore (*Holtum* ♂) may also be this species.

*Distrib*: Endemic.

A mountain shrub. *Branchlets* slender, terete or obscurely 4-angled with dark longitudinally wrinkled bark. *Leaves* rather thick, narrowly obovate or rhomboid, apex acuminate, often shortly and abruptly, base long narrowed on to petiole, 4 cm.  $\times$  1.5 cm. to 5 cm.  $\times$  3 cm.; upper surface drying brownish, somewhat polished, minutely punctate, lower surface paler, dull, copiously black dotted; midrib impressed above, not raised below except at base where it is slightly keeled; *primary nerves* numerous and close together, slightly raised above but obscure, invisible or very obscure below; petiole up to c. 5 mm. long, wrinkled.

*Inflorescences* terminal, paniced, up to c. 3 cm. long, with about 2 pairs of short branchlets, angled, bark dark and wrinkled. *Flowers* in threes at branchlet ends, sessile; *calyx* 9–10 mm. long, grey and wrinkled when dry, c. 5 mm. across mouth after anthesis, more or less funnel shaped, tapering to base without definite pseudostalk; lobes 4, small, broadly ovate triangular, c. 2–3 mm. across and 1 mm. tall; *petals* apparently 4, with one free and the others falling as a thick calyptra, the free petal transversely oblong-orbicular, thick textured, a little more than 3 mm. across and 2 mm. tall; *stamens* many, up to c. 4.5 mm. long, filaments subulate, stout at base, tapering upwards, anthers transversely oblong; *style* very stout, c. 5 mm. long; *ovary* 2-celled below, 3-celled above. *Fruit* unknown.

Distinct in this group in the small obovate or rhomboid leaves usually with the apex abruptly acuminate, and in the narrow rugose calyx with very small lobes, rather short stout stamens and the very stout short style.

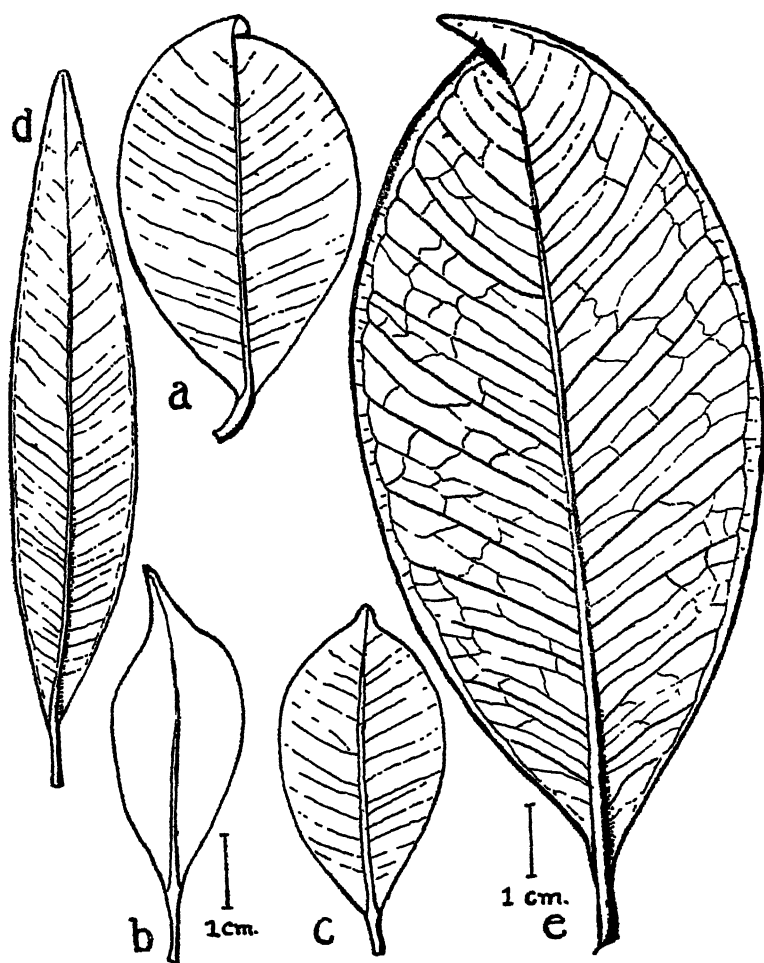


Fig. 16. a, b, c, *E. rhomboidea*; d, *E. salictoides*; e, *E. selangorensis*.

26. *Eugenia salictoides* Ridl. in Journ. Roy. As. Soc. Str. Br., LXVIII, 12 (1915); F.M.P., I, 728. (Fig. 16d).

PAHANG: Tahan river banks, Ridley 2647, 16396; Sungai Tahan, SFN 20546 (Holttum), Corner s.n., Forest Dept. FMS 42944; Sungai Teku, Seimund s.n.

*Distrib*: Endemic.

A bush, bark smooth, pale grey or pale brown with dark irregular lines, creviced. *Twigs* terete, smooth, with brownish or greyish creviced bark. *Leaves* narrow lanceolate, coriaceous, willow-like, up to c. 12 cm. long and 1.6 cm. wide, apex acuminate, blunt or subacute, base long tapered, petiole dark coloured, wrinkled, c. 5 mm. long; midrib impressed above, prominent and more or less keeled below; *primary nerves* up to c. 40 pairs, impressed above, faint and inconspicuous, elevate and very fine below, 2–3 mm. apart, but irregular in spacing, meeting in a fine intramarginal nerve less than 1 mm. from leaf margin; secondaries and reticulations practically invisible above, the secondaries below difficult to distinguish from primaries, the reticulations a little fainter; upper surface drying almost black, minutely punctate, lower surface dark brown, sometimes minutely black punctate, sometimes more or less pustulate.

*Panicles* terminal or from upper leaf axils, up to c. 10 cm. long, peduncle slender, variable in length, usually c. 2–3 cm., bark often pustulate, branchlets slender, 1–2 cm. or sometimes longer, bearing at their apices 3 flowers, either all sessile or the outers on exceedingly short pedicels less than 1 mm. long, with very minute and obscure broad blunt bracts; mature flower buds narrowly pyriform, c. 1 cm. long, the opened *calyx* narrowly campanulate, gland dotted, tapering into a slender pseudostalk c. 3–5 mm. long, lobes 4, semi-orbicular, gland dotted, eventually reflexed, persistent; *petals* 4, free, gland dotted; *stamens* numerous, up to c. 1.6 cm. long, style as long.

*Fruit* globose, up to c. 1 cm. diam., crowned by a very short calyx rim and the persistent calyx lobes, pericarp almost black and finely longitudinally wrinkled when dry, thin; testa brownish, rather thick and pithy, stripping with pericarp; seed globose, c. 7–8 mm. diam., cotyledons nearly equal, pustulate, inner faces also pustulate, slightly concave; cotyledons sessile, attached to hypocotyle near periphery of seed, radicle and plumule small.

A riverside bush which might almost be regarded as the extremest form of *E. densiflora* var. *angustifolia*. Easily recognised in this group by the very narrow leaves and long stamens.

27. *Eugenia garcinifolia* King, Mat. F.M.P., No. 12, 90 (1901); Ridl., F.M.P., I, 730. *Syzygium garcinifolium* (King) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 167 (1939). (Fig. 17a).

PERAK: Larut, 300–500 feet, *Kunstler 6974*; Gopeng, 500–1,000 feet, *Kunstler 4541*.

JOHORE: 3rd mile Mawai-Jemaluang road, *SFN 31469* (Corner).

*Distrib.* Sumatra, Borneo.

A tree up to c. 30 m. tall with sharp thin spreading buttresses to c. 25 m.; bark light buff grey, rather lenticellate-pustular, scaly with oblong angular pieces, not fissured; inner bark pinkish brown, heart wood red brown.

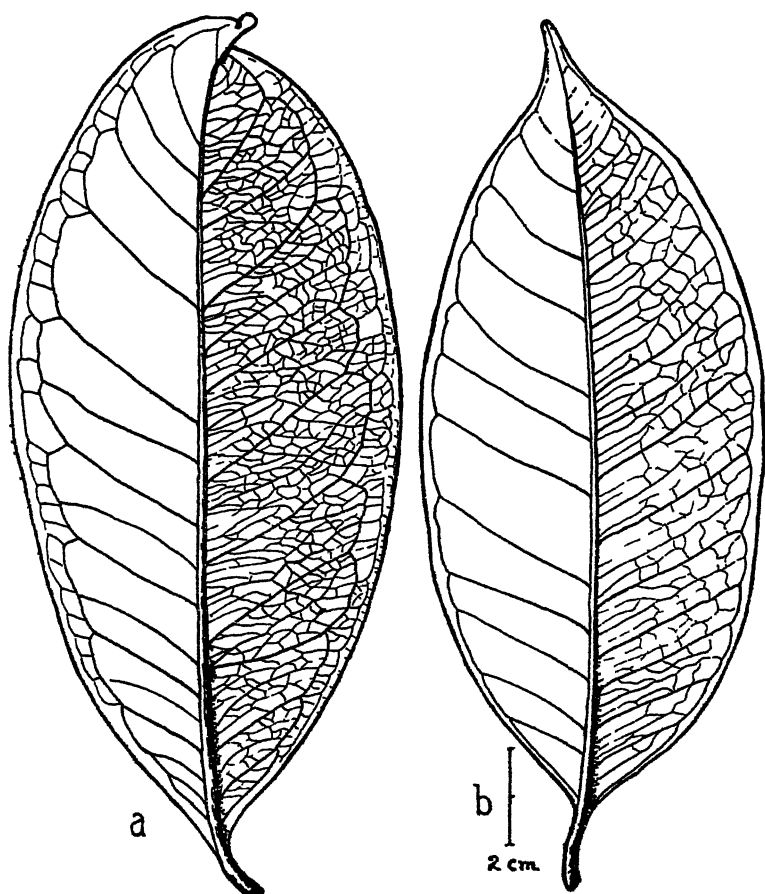


Fig. 17. a, *E. garcinifolia*; b, *E. palembanica*.

*Twigs* stout, angled, bark smooth, pale brown. *Leaves* thickly coriaceous, elliptic or elliptic oblong, with a tendency to be obovate, from c. 13 cm.  $\times$  5 cm. to 20 cm.  $\times$  10 cm., apex abruptly and shortly acute or acuminate, base narrowed, margins recurved when dry; upper surface drying greenish brown or pale brown, black dotted or glandular pustulate, lower surface dull, brownish or yellowish green, minutely gland dotted; midrib deeply impressed above, prominent below, longitudinally wrinkled; *primary nerves* up to c. 12 pairs, raised above, rather prominent below, ascending, curving up and interarching to form a looped sometimes rather irregular intramarginal nerve 5–10 mm. from leaf margin, with another quite distinct series of arches closer to the margin; secondaries and close reticulations raised above and below and very distinct, but distinguishable from primaries; petiole channelled above, drying black and wrinkled, 1.5–2.5 cm. long.

*Panicles* terminal, c. 7 cm. long and about the same across, the rachis stout but thinner than twigs, strongly angled, striate; branchlets spreading, up to c. 2 cm. long, compressed and striate, pale brown or brown; *flowers* white, borne singly on stout pedicels 2–5 mm. long, bracts minute, subpersistent, broadly ovate triangular reflexed; *calyx* c. 1.5 cm. long, narrowly cylindric campanulate, narrowed at base into an obscure very stout pseudostalk c. 2–3 mm. long; lobes 4, unequal, spreading, persistent, broad and rounded, the larger inner ones c. 7 mm. across at base and 4 mm. tall, with thin margins; *petals* 4, free, persisting until after flower is fully expanded, orbicular with a short broad oblong claw, c. 1 cm. diam., gland dotted; *stamens* numerous, up to c. 3 cm. long, filaments very slender, broadened at base, anthers narrowly oblong, 1 mm. long, connective gland inconspicuous; *style* much stouter than filaments and about the same length.

*Fruit* (? unripe) globular ovoid, c. 1 cm. diam., apical excavation 3–4 mm. diam., fringed by the 4 hardly enlarged erect sepals.

A distinct species by reason of its large size, large thick leaves with well marked reticulation on both surfaces and the large flowers with narrow calyx tube.

28. *Eugenia selangorensis* Ridl. in Journ. F.M.S. Mus., V, 32 (1915); F.M.P., I, 730. (Fig. 16e).

SELANGOR: Gunong Mengkuang, 5,000 feet, Robinson s.n. (type collection).

A tree, (fide Ridley). *Twigs* stout, terete, bark brownish. *Leaves* very coriaceous, elliptic, up to c. 12 cm.  $\times$  6 cm., apex shortly and abruptly acuminate, deflexed, base narrowed, upper surface drying brownish, not

punctate, lower surface blackish, closely covered with very minute white glistening glands; midrib deeply impressed above, prominent below and more or less keeled; *primary nerves* 15–20 pairs, 3–7 mm. apart, fine and impressed above, slender and slightly elevate below, ascending and curving up to a slender intramarginal nerve 2–3 mm. from the recurved leaf margin, with a very obscure series of arches nearer the margin; secondaries almost as distinct as primaries, impressed above, elevate below, reticulations raised and just visible above, more distinct below, lax; petiole rather stout, c. 1 cm. long, the leaf blade decurrent upon it.

*Panicles* terminal, c. 4 cm. long, sessile or on a very stout greyish peduncle c. 1 cm. long, branchlets short, very stout, compressed, bark grey, wrinkled and often pustulate; *flowers* sessile, in threes at ends of the secondary branchlets or on exceedingly short tertiary branchlets; *calyx* in mature bud c. 1 cm. long, broadly funnel shaped, narrowed to a short thick ribbed pseudostalk; lobes 4, very unequal, broad and rounded, the inner larger ones c. 6 mm. across and 3 mm. tall; *petals* 4, free, transversely oblong ovate, c. 7 mm. across and 4 mm. tall, persisting until after flower is fully open; *stamens* numerous, up to c. 1.5 cm. long, filaments slender, anthers ovate globose, c. 0.5 mm. long, connective gland small and inconspicuous; *style* stouter than filaments and shorter than them; *ovary* 2-celled. *Fruit* unknown.

This species is known from only one collection and may be no more than a mountain variety of *E. palembanica*, differing in the somewhat narrower and thicker leaves and the much shorter inflorescence with much stouter branches, and a less well marked pseudostalk.

There are in Herb. Singapore a few collections from elevations of 4,500–5,000 feet which seem to be intermediate between *E. selangorensis* and *E. palembanica*. These are:

PERAK: Gunong Bubu, 5,000 feet, *Wray* 3907, 4,500 feet, *Wray* 3908, 3914; Gunong Batu Puteh, 4,500 feet, *Wray* 415.

PAHANG: Pinetree Hill, Fraser Hill, 4,800 feet, *SFN* 8535 (*Burkill & Holttum*).

29. *Eugenia palembanica* (Miq.) Merr. in Journ. Roy. As. Soc. Str. Br., LXXVII, 225 (1917); Corner, Wayside Trees of Malaya, p. 500, fig. 168. *Syzygium palembanicum* Miq., Fl. Ind. Bat., Suppl. I, 313 (1860). *Eugenia lepidocarpa* Kurz in Journ. As. Soc. Beng., XLVI, ii, 68 (1877); Duthie in Hook. fil., F.B.I., II, 476; King, Mat. F.M.P., No. 12, 89; Ridl., F.M.P., I,

730; Wall. Cat. 3618, nom. nud. *E. grandis* var. *lepidocarpa* Kurz., For. Fl. Burma, I, 490 (1877). (Fig. 17b).

Common in lowland forest, up to about 2,000 feet, and on sandy seashores from Trengganu to Singapore, but not recorded from Perak or further north on the west coast.

*Distrib:* Burma, Sumatra, Borneo.

A tree up to c. 15 m. tall; usually without buttresses or stilt roots; bark dull rufous fawn or pinkish brown, finely reticulately fissured with elongate meshes, not or scarcely flaky; inner bark fairly thick, stripping easily, deep purple brown. *Twigs* usually rather stout, terete, with smooth or slightly flaky greyish or brownish bark. *Leaves* coriaceous, ovate oblong, elliptic, elliptic oblong, occasionally more or less ovate, occasionally lanceolate, rarely obovate oblong, from c. 7 cm.  $\times$  3 cm. to 17 cm.  $\times$  11 cm., apex blunt or subacute or with a short abrupt point, base cuneate, or rounded and abruptly and shortly narrowed on to petiole; upper surface somewhat polished, drying olivaceous brown to black, usually very minutely and closely punctate, lower surface dull, usually darker than the upper, closely covered with very minute whitish glistening scale-like glands; midrib deeply impressed above, prominent below, rounded or more or less keeled; *primary nerves* c. 10–17 pairs, usually 1–1.5 cm. apart, fine on the upper surface and usually slightly elevate, occasionally lightly impressed, raised below and usually quite distinct, ascending, running straight or curving gently up to an intramarginal nerve 2–3 mm. from leaf margin; secondaries and reticulations raised above or almost or quite invisible, the secondaries below usually raised and distinct but less prominent than the primaries, the reticulations raised and visible or obscure or invisible; petiole up to c. 1.5 cm. long.

*Panicles* terminal or rarely from upper axils, often clustered, usually shorter than leaves; branchlets numerous, spreading or ascending, rather stout, compressed and angled with blackish striate and wrinkled bark; *flowers* sessile or occasionally very shortly pedicellate, clustered at apices of branchlets, fragrant, calyx pale green, petals and stamens white, disc pale brownish yellow, c. 3 cm. across when fully expanded; *calyx* c. 1 cm. long. globose clavate in bud, more or less campanulate after anthesis, rather suddenly narrowed to a distinct rather stout pseudostalk 2–3 mm. long, the tube from a little below lobes to base of pseudostalk distinctly ribbed when dry; lobes 4, unequal, not persistent, transversely oblong ovate, c. 3–4 mm. across and 2 mm. tall; *petals* 4, free, persisting until after anthesis, semiorbicular, c. 5 mm. diam., rather thick textured with thin margins; *stamens* numerous, up to c. 1.5 cm. long, filaments slender,

subulate, anthers broadly ovate, c. 0.7 mm. long, connective gland small, brownish; *style* stouter than filaments, c. 1.3 cm. long; *ovary* 2-celled, multiovulate. *Fruit* c. 2 cm. diam., globose, sharply vertically ribbed when dry, crowned by the cupular calyx rim.

Related to *E. grandis* but leaves usually smaller with less prominent venation, flowers smaller and more abruptly narrowed at base, calyx ribbed, fruit smaller, vertically ribbed and with a prominent cupular calyx rim.

30. *Eugenia grandis* Wight, Ill., II, 17 (1841); King, Mat. F.M.P., No. 12, 96; Gagnep. in Fl. Gen. Indo-Ch., II, 826; Ridl., F.M.P., I, 729; Corner, Wayside Trees of Malaya, p. 498, pl. 148, 149, fig. 168. *Syzygium grande* (Wight) Walp., Repert., II, 180 (1843); Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 176. (Fig. 18a).

Wild only on sandy and rocky seacoasts. Much planted inland as a roadside tree.

*Distrib*: Burma, Indo-China, Siam, Borneo.

A big tree, up to c. 30 metres tall; bark greyish buff or pinkish, rough, shallowly fissured, somewhat flaky in big trees; inner bark pale pink to dark reddish, pale yellow near surface. *Twigs* rather slender, terete, brownish or greyish with smooth or slightly flaky bark. *Leaves* coriaceous, elliptic, elliptic oblong, ovate elliptic or ovate rotund, up to c. 25 cm.  $\times$  12 cm. or more in saplings, usually smaller, apex more or less shortly acuminate and deflexed, or blunt, base cuneate, or broad and narrowed abruptly on to petiole; upper surface shining in life, minutely glandular punctate, slightly bullate, drying olivaceous to blackish, lower paler in life, dull, with a close covering of very minute pale glistening scaly glands as in *E. palembanica*, drying dark brown or reddish, the glands then almost invisible; midrib impressed above, elevate below and longitudinally wrinkled; *primary nerves* up to c. 14 pairs in large leaves, usually 1–2 cm. apart, usually elevate and slender above, elevate below and slightly ascending, nearly straight or very slightly curved up to an intramarginal nerve 3–6 mm. from leaf margin with often a fainter loop very close to the margin; secondaries and reticulations usually raised on both surfaces and distinct, but less prominent than primaries; petiole channelled above, drying black, up to c. 2 cm. long.

*Panicles* terminal or from uppermost axils, often clustered, up to c. 14 cm. long, pedunculate or nearly sessile, rachis and spreading branchlets more slender than

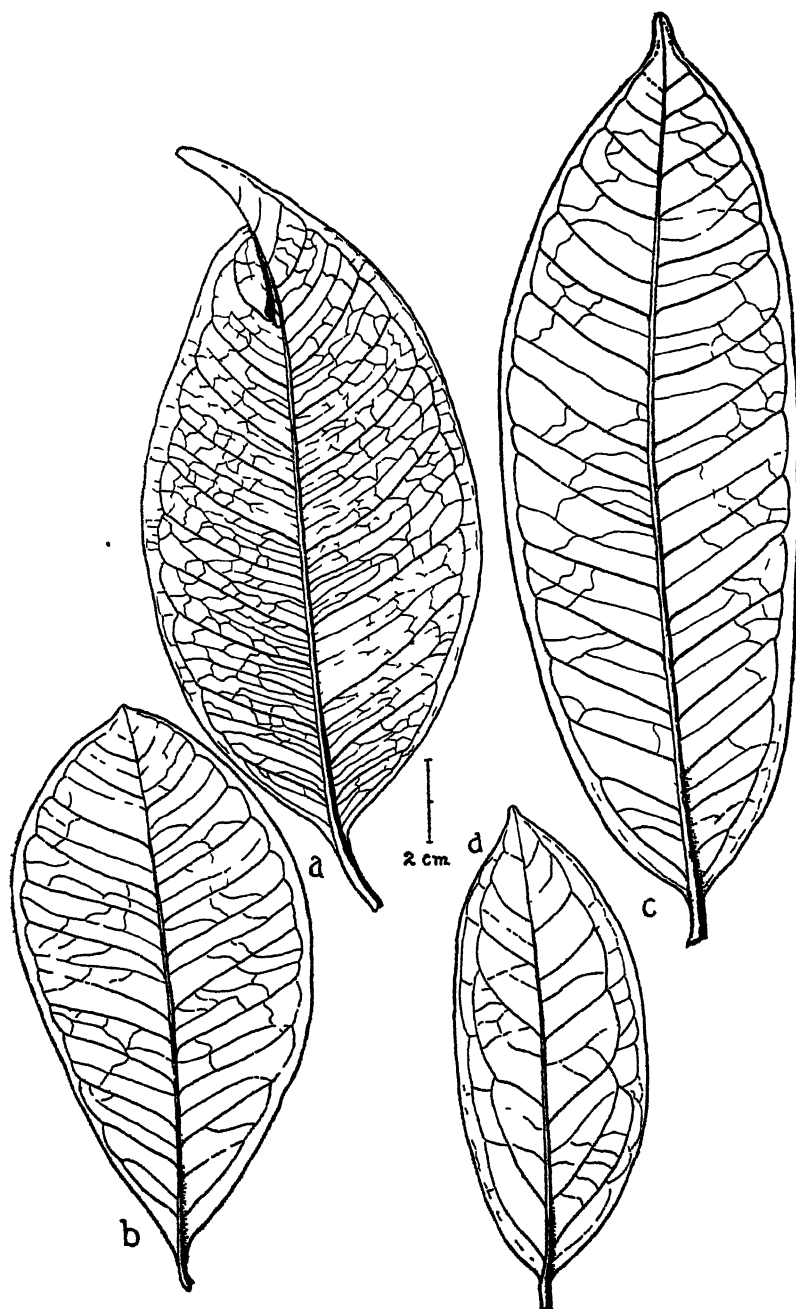


Fig. 18. a, *E. grandis*; b, *E. pachyphylla*; c, *E. atronervia* (small leaf); d, *E. Millen*.

twigs, compressed, drying dark brown or black; *flowers* c. 2.5–3 cm. across when expanded, fragrant, calyx pale yellow green, petals and stamens white, disc yellow, in threes at branchlet ends, sessile or pedicellate, the outer two flowers of the triads usually sessile or occasionally very shortly pedicellate, the centre flower sometimes on a pedicel as much as 4 mm. long, sometimes sessile; *calyx* c. 1.2 cm long, narrowly campanulate, c. 6–7 mm. across apex before expansion, very slightly constricted below lobes and tapering to a short not very distinctly marked pseudostalk c. 2 mm. long, which is more evident in the dried flower; tube nearly smooth; lobes 4, very unequal, subpersistent, the two outer very short and broad, 1–2 mm. tall, the two inner petaloid, orbicular, concave, thinner, gland dotted, c. 5 mm. diam; *petals* 4, white tinged pale green, more or less orbicular, c. 5 mm. diam., reflexed after anthesis; *stamens* numerous, filaments slender, subulate, up to c. 1.5 cm. long, anthers ovate oblong, or broadly oblong, c. 0.6–0.7 mm. long, connective gland very small and inconspicuous; *ovary* 2-celled, multiovulate.

*Fruit* more or less globular, often a little compressed laterally, or elliptic or elliptic oblong, more or less asymmetric, up to c. 4 cm.  $\times$  3 cm., green when ripe with very faint narrow longitudinal stripes of slightly darker green; apical umbilicus deep, 8–9 mm. diam., fringed with remains of calyx tube and occasionally the calyx lobes, style base persistent; pericarp pithy-leathery, white, c. 3 mm. thick, slightly sweet; seed globose or compressed, up to c. 2.5 cm. diam., testa thick, crustaceous, not easily removed from cotyledons, c. 1 mm. thick; cotyledons nearly equal, very pale green with minute slightly darker dots, inner faces more or less plane, attached to hypocotyle c. 5 mm. from periphery of seed, sessile. Germination hypogeal.

A large fruited form has been found in Government House Domain, Singapore. Its fruits are elliptic to obovoid, pale green to medium green with faint longitudinal narrow lines of darker green, up to c. 5 cm.  $\times$  3.5 cm., pericarp white, pithy, slightly juicy, sweet, edible, c. 5 mm. thick, increasing to c. 10 mm. at apex and base of fruit, not so tough as in the ordinary form; apical umbilicus 7–10 mm. diam., deep, fringed with the remains of the calyx lobes and bearing style base; seed 1, more or less conforming to shape of fruit, c. 2.5  $\times$  2 cm., testa pale brown, thick, crustaceous, closely adhering to cotyledons; cotyledons sessile, superposed, one inner face concave, the other convex, surfaces very pale yellow, pink tinged.

31. *Eugenia pachyphylla* Kurz in Journ. As. Soc. Beng., XLII, ii, 332 (1874); Duthie in Hook. fil., F.B.I., II, 477; King, Mat. F.M.P., No. 12, 89; Ridl., F.M.P., I, 733; Corner, Wayside Trees of Malaya, p. 500, fig. 168. *Syzygium pachyphyllum* (Kurz) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 168 (1939). (Fig. 18b).

Not uncommon in lowland forest from Kedah and Kelantan to Singapore, and often in ricefields in the north of the Peninsula.

*Distrib.*: Burma, Siam, Borneo.

A tree up to c. 13 m. tall; bark rather rugose and tessellately flaky (description from trees in open), pale pinkish grey; inner bark pale pinkish fawn, thick. *Twigs* rather stout, terete, with pale yellow or pale brownish polished bark. *Leaves* coriaceous, obovate to oblong obovate or oblanceolate, apex apiculate or shortly and abruptly acuminate or shortly and bluntly acute, base cuneate and narrowed on to petiole, from c. 6 cm.  $\times$  2 cm. to 16 cm.  $\times$  8 cm.; upper surface drying olivaceous brown to blackish brown, very minutely punctate, lower surface pale brown to reddish brown, with darker pustulate glands; midrib impressed above, prominent below; *primary nerves* up to c. 15 pairs, spreading-ascending, meeting in a rather faint looped intramarginal nerve 1-3 mm. from leaf margin, obscure and slightly raised above, slender below but distinct; secondaries and reticulations obscure above, faint below; petiole drying black, usually less than 1 cm. long.

*Inflorescences* terminal or from upper axils, usually paniculate, sometimes racemose, usually clustered, up to c. 17 cm. long but usually c. 7 cm., usually pedunculate, the rachis sometimes elongate, up to 13 cm. long without branchlets; peduncle, rachis and branchlets more or less 4-angled or compressed with brownish or blackish striate bark; *flowers* white, sessile, usually in threes at apices of branchlets, buds globose clavate c. 1 cm. long; *calyx* after expansion c. 1 cm. long, c. 1.5 cm. across mouth and lobes, broadly funnel shaped, tapering from below the lobes to a broad rounded base, the tube gland dotted and with conspicuous longitudinal rounded ridges; lobes 4, spreading after anthesis, broadly triangular rounded, c. 5-6 mm. across at base and 3 mm. tall; *petals* 4, free, quickly deciduous, suborbicular; *stamens* numerous, c. 1.5 cm. long, anthers ovate oblong, c. 0.8 mm. long, connective gland present; *style* stout at base, tapering upwards and slender above, c. 1.7 cm. long; *ovary* 2-celled, multiovulate.

*Fruit* obovoid or oblong-obovoid with flattened apex, c. 2.5 cm. long and 2 cm. across, smooth with a few shallow vertical ridges, pericarp pulpy, about 5 mm. thick at thickest

point; apex with shallow dark coloured depression bearing remains of style and on its margin the fleshy incurved enlarged calyx lobes; seeds one or two, if two hemispherical, if one, more or less globose, c. 1.2–1.4 cm. diam., the testa adhering closely to cotyledons; cotyledons nearly equal, attached to hypocotyle near middle of inner faces, shortly stalked; hypocotyle stout, reaching periphery of seed.

32. *Eugenia atronervia* Henderson in Gardens' Bulletin, Singapore, XI, 299, fig. 1 (1947). (Fig. 18c).

JOHORE: Sungai Kayu Ara, Mawai-Jemaluang road, at low elevations in dry *Dryobalanops* forest, SFN 24328 (Corner); 2nd mile, Mawai-Jemaluang road, Corner s.n. Known only from these collections.

A tree 10–12 m. tall, 10 cm. diam. 2 m. from ground, with low flattened stilt roots. Bark dull rufous fawn, smooth, entire, becoming slightly creviced, not pustulate or flaky; inner bark dull madder brown or purplish brown, wood dull reddish brown. Twigs very stout, rounded or somewhat flattened, not angled, bark black or brown, smooth or somewhat ridged, not flaky. Leaves large, narrowly elliptic, or oblong elliptic or oblong lanceolate, up to c. 36 cm. long and 16 cm. broad, apex shortly and abruptly acuminate, base shortly narrowed and more or less decurrent on petiole; upper surface drying dull fuscous brown, lower surface a warm red brown; primary nerves c. 17–21 pairs, somewhat raised above and quite conspicuous as are the reticulations, strongly raised and black below, the lax reticulations also raised and evident, but much less conspicuous than the primaries; secondaries few to none; primaries nearly straight or gently curving up to a slightly looped, well marked intramarginal nerve c. 3 mm. from leaf margin; petiole very stout, widely channelled above, drying black, c. 2 cm. long.

Inflorescence terminal, from 2–5.5 cm. long, stout, the largest with a 4-angled peduncle c. 2 cm. long, with two pairs of stout branchlets, the lower pair 7–8 mm. long, each with 3 terminal flowers, the upper pair distant from the lower by 2.5 cm., each c. 2 mm. long with three flowers each, inflorescence axis produced 5 mm. above upper branchlets and bearing 4 flowers; other inflorescences much shorter, c. 2 cm. long, with one pair of very short stout branchlets each with 3 flowers, and 3 terminal flowers. Flowers sessile, buds more or less obovoid, calyx campanulate or obconic, rather abruptly narrowed into a very short stout pseudostalk, c. 1.8 cm. long, flower c. 2 cm. across when expanded; calyx lobes 4, persistent, broad, rounded, c. 5 mm. long and 6–7 mm. broad; petals free, not quickly

deciduous, of same shape and size as sepals but thinner in texture; *stamens* c. 1 cm. long; *style* c. 1.5 cm. long; *ovary* 2-celled, multiovulate.

*Fruit* more or less depressed globose, up to c. 4 cm. diam., apex with a rather deep excavation c. 5 mm. diam., fringed by the very short (c. 1 mm. tall) remains of calyx tube, bearing withered stamens; surface of fruit nearly black, corrugate with broken shallow vertical ridges and furrows, smooth in places; pericarp probably pulpy or fleshy, up to c. 6 mm. thick; seed 1, transversely oblong globose, c. 2.7 cm. across, testa very thick, adhering closely to cotyledons; cotyledons side by side, nearly equal, outer surface finely rugulose, inner faces conspicuously glandular pustulate, nearly plane with a shallow wide depression, sessile, plumule and radicle rather small, attached near periphery of seed.

This species is characterised by its large leaves, short inflorescences and large flowers. It is probably allied to *E. Dyeriana* King and *E. Hemsleyana* King, but differs from both in the much larger leaves, shorter inflorescence and much larger flowers. It may also be allied to *E. pergamentacea* King but differs from that species in its larger flowers and by the nerves not being impressed on the upper surface of the leaf.

33. *Eugenia Millsii* Henderson in Gardens' Bulletin, Singapore, XI, 301, fig. 2 (1947). (Fig. 18d).

KEDAH: Sungai Terap, near Selama, in forest on riverbank at low altitude, SFN 35431 (Henderson).

Known only from one collection.

A tree c. 14–17 m. tall, diam. c. 45 cm. at 2 m. from ground, trunk fluted up to c. 2 m. from ground. Bark smooth with irregular surface cracks, brownish grey. *Twigs* terete, stout, bark greyish white or pale brown, smooth, somewhat polished. *Leaves* coriaceous, elliptic or oblong elliptic, up to c. 15 cm. long and 6 cm. broad, base cuneate, apex shortly and bluntly acute, or sometimes more or less acuminate, drying dull brown or cinereous above, dull warm brown below, both surfaces minutely punctate; petiole pale coloured, 5–10 mm. long; midrib impressed above, raised below; *primary nerves* 5–10 pairs, visible but not conspicuous above, very slightly raised and very slightly channelled, raised below and more or less conspicuous, the second or third pair from the base initiating a conspicuous intramarginal nerve 5–8 mm. from the leaf margin, the basal one or two pairs running up in a fainter intramarginal c. 1–3 mm. from margin; secondaries a little finer and less conspicuous than primaries, reticulations practically invisible when dry; petiole 5 mm. or less long, pale.

*Inflorescences* terminal or from upper axils, of fascicled panicles not exceeding c. 7–8 cm. long, peduncles stout with pale bark, more or less 4-angled and striate. *Flowers* white, in threes at ends of branchlets, the centre flower of the triads sessile, the two outers on very short stout pedicels; *calyx* tube campanulate, c. 4 mm. long and slightly less across base of lobes, slightly contracted just below lobes, narrowed to a stout pseudostalk less than 1 mm. long; lobes 4, semiorbicular, persistent, c. 4 mm. tall and 5 mm. wide; *petals* 4, persistent for some time after the flower is fully open, orbicular, 6 mm. tall and 6.5 mm. wide, free; *stamens* numerous, longest filaments c. 10 mm. long, anthers oblong or broadly elliptic, 0.5–0.6 mm. long; *ovary* 2-celled with many ovules; *fruit* unknown.

Possibly allied to *E. densiflora* var. *angustifolia* but differing in being a fair sized tree, not a bush, with flowers which are smaller and of a different colour. The venation also differs considerably.

34. *Eugenia kemamanensis* Henderson in Gardens' Bulletin, Singapore, XI, 303, fig. 3 (1947). (Fig. 19a).

KEMAMAN: Ulu Ayam, Kajang, c. 500 feet, in forest, SFN 30352 (Corner).

Known only from one collection.

A tree c. 8–9 m. tall, bark silvery grey, even, entire; inner bark pale pink, green below surface, wood pale buff. *Twigs* terete, with smooth or somewhat striate bark, pale silvery grey when dry. *Leaves* elliptic to elliptic lanceolate, sometimes more or less obovate, apex bluntly acute or shortly bluntly acuminate, narrowed to a rounded or truncate base, up to 18–19 cm. long and 8–9 cm. broad; drying pale brown on both surfaces, the upper surface usually rather darker than the lower, both surfaces minutely rugose when dry; midrib deeply impressed above, strongly elevate below; *primary nerves* distant, c. 9–11 pairs, fine and sunk above, raised below, slender but conspicuous, meeting in a well marked looped intramarginal nerve c. 0.5–1 cm. from leaf margin, with a much fainter intramarginal much nearer the margin; reticulations very faint or invisible above, very fine and lax below; *petiole* pale, rather stout, c. 5 mm. long.

*Inflorescences* from below leaves or on side twigs, practically sessile, c. 4 cm. long, rachis slender, 4-angled or compressed, with a few distant slender branchlets up to c. 2 cm. long, terminated by flowers in threes; pedicels not exceeding 2 mm. long. *Flower* buds c. 4–6 mm. long, obconic, tapering to a short pseudostalk; *calyx* lobes 4,

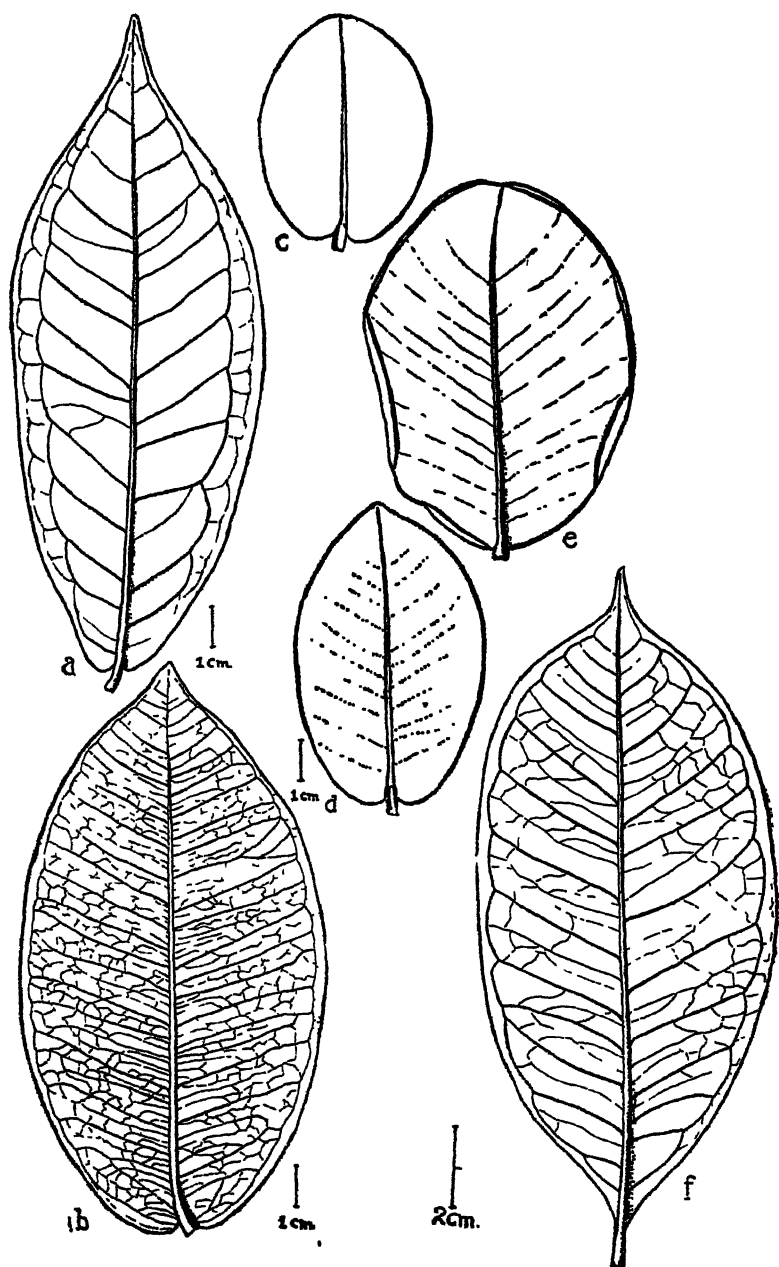


Fig. 19. a, *E. kemamanensis*; b, *E. subdecussata*; c, d, *E. subdecussata* var. *montana*; e, *E. viridescens*; f, *E. Hoseana*.

broad, rounded, concave, c. 4-5 mm. broad and 3 mm. tall., *petals* 4, falling as a calyptra, but separable, similar in shape to calyx lobes but slightly larger and thinner in texture; *stamens* c. 4 mm. long; *style* c. 4-5 mm. long.

*Fruit* globose to depressed globose, up to 2.3 cm. diam., calyx rim very wide, c. 1.4 cm. diam., apex of fruit not excavate but slightly convex with more or less persistent, widely separated remains of calyx lobes; pericarp fleshy, testa brownish; cotyledons side by side, nearly equal, opposing faces nearly plane, except for a narrow radial ridge on one fitting into a corresponding groove on the other, shortly broadly stalked.

Very little material of this species is known, but it appears to be sufficiently distinct and not closely related to any other Malayan species.

35. *Eugenia cordifoliata* Ridl. in Journ. Roy. As. Soc. Str. Br., LXXIX, 66 (1918); F.M.P., I, 736. *E. Swettenhamiana* King, Mat. F.M.P., No. 12, 126 (1901), quoad specimina Scortechiniana.

PERAK: sine loc., *Scortechini s.n.* (type collection).

Known only from the above collection. See note under *E. Swettenhamiana*.

? A tree. *Branches* terete, pale. *Leaves* elliptic, membranous, c. 10 cm.  $\times$  3.5-4 cm., apex bluntly acuminate, narrowed to a rounded subcordate almost peltate base, upper surface drying blackish, lower paler; *primary nerves* c. 18 pairs, obscure above, slightly elevate below, meeting in an intramarginal nerve; petiole short, stout, less than 5 mm. long.

*Panicles* terminal, lax, c. 15 cm. long on a peduncle c. 5 cm. long, branchlets angled, up to c. 7.5 cm. long; *flowers* in threes at branchlet ends; buds pyriform, narrowed to a slender pseudostalk, calyx lobes ovate. *Fruit* unknown. (ex Ridley).

36. *Eugenia subdecussata* Duthie in Hook. fl., F.B.I., II, 491 (1878); King, Mat. F.M.P., No. 12, 121, incl. var. *colorata* King; Ridl., F.M.P., I, 752; Corner, Wayside Trees of Malaya, p. 503, fig. 168. *E. colorata* Duthie, loc., cit., 492. *Syzygium subdecussatum* Wall. Cat., nom. nud. (Fig. 19b).

Common in lowland forest from Penang to Singapore, mostly to the west of the Main Range, but also on the rocky shores and islands of the east coast.

*Distrib*: Sumatra.

A tree up to c. 24 m. tall, trunk slightly fluted at base or not; bark smooth, becoming rather finely and closely

reticulately creviced or fissured, not scaly rugose or pustulate, pinkish brown, often with greyish bloom; inner bark thick, pale pinkish brown to reddish buff. *Twigs* slender, terete, compressed below nodes, with brownish or greyish smooth or slightly flaky bark. *Leaves* thickly coriaceous, elliptic or oblong elliptic, sometimes elliptic ovate or elliptic obovate, from c. 5 cm.  $\times$  2 cm. to c. 15 cm.  $\times$  7 cm., apex acute, or acuminate, often very shortly and abruptly so, sometimes rounded, base more or less narrowed and more or less cordate, occasionally cuneate; upper surface polished, drying brown to blackish brown, minutely punctate, lower surface dull, drying brown to reddish brown, closely pustulate glandular with minute pale scale-like glands; midrib impressed above, prominent below and more or less keeled or longitudinally wrinkled; *primary nerves* up to c. 15 pairs, c. 0.5–1 cm. apart, usually spreading ascending and meeting a fine intramarginal nerve 1–3 mm. from leaf margin, slightly elevate and very slender on both surfaces but more distinct below, the secondaries below often as distinct as primaries, the reticulations when visible almost as distinct as secondaries; petiole less than 5 mm. long, the leaves often subsessile.

*Panicles* terminal or occasionally from upper axils, up to c. 10 cm. long, often clustered, usually pedunculate, peduncles from less than 1 cm. long to c. 5.5 cm., the peduncle, rachis and branchlets rather slender, much compressed, with dark striate bark, lower branchlets ascending, 2–4 cm. long, the upper ones spreading, shorter; *flowers* white, calyx green often flushed purple at apex, clustered at ends of branchlets or on very short tertiary branchlets, buds clavate, c. 6 mm. long; *calyx* funnel shaped, c. 5 mm. long, c. 3 mm. across mouth, narrowed to a rather stout pseudostalk c. 3 mm. long, lobes 5, obscure, very shortly and broadly triangular; *petals* calyptrate; *stamens* numerous, filaments slender, up to c. 3.5 mm. long, anthers broadly ovate, c. 0.4 mm. long, connective gland rather conspicuous; *style* very stout, c. 3.5 mm. long; *ovary* 2-celled.

*Fruit* globose or pyriform up to c. 2.5 cm. diam., smooth, green flushed dull red pink on one side when ripe, apical umbilicus narrow and deep, c. 3–4 mm. diam., without calyx tube but fringed with remains of calyx lobes; pericarp thin, sweetish, 2–3 mm. thick; seed 1, more or less globose, testa very thick and pithy, closely adhering to the cotyledons; cotyledons equal, side by side, creamy pale brown, slightly rugose and conspicuously gland dotted, inner faces slightly concave, gland dotted, attached centrally to the hypocotyle by very short broad stalks.

*E. subdecussata* Duthie var. *montana* King, Mat. F.M.P., No. 12, 191 (1901). (Fig. 19c, d).

Common in mountain forest on the Main Range and recorded also from Kedah Peak and Gunong Sagi in Kelantan.

This variety differs from the typical form in having a more or less shrubby habit and smaller and broader and blunter leaves. The leaves, however, vary considerably, from almost rotund, obtuse at apex and cordate at base, to oblong elliptic or obovate with a short blunt point and rounded or cuneate at base. In view of the great variation in leaf form in both the typical and varietal forms and also of the fact that the typical form is by no means confined to the lowlands, it seems probable that var. *montana* is hardly worth keeping up.

As King points out, *Syzygium apodum* Miq., Fl. Ind. Bat. Suppl. I, 312 (1860) is very close to *E. subdecussata*. I have seen a sheet of what is probably the type collection (leg. *Teysmann*, Sumatra ad littora Siboga) preserved in Herb. Calcutta. This differs from *E. subdecussata* in the blunter leaves with more pronounced recurved margins, the polished yellow paler branches and the slightly thicker inflorescence branchlets. Typical *E. subdecussata* is known from Sumatra, and further collections and collections of fruit may show that *S. apodum* is distinct. If it is regarded as conspecific with *E. subdecussata*, Miquel's specific epithet will take precedence over Duthie's, for *Syzygium subdecussatum* Wall. is a *nomen nudum* not validated until 1878.

37. *Eugenia viridescens* Ridl. in Journ. Linn. Soc., XXXVIII, 308 (1908); F.M.P., I, 752. (Fig. 19e).

PAHANG: Gunong Tahan, *Ridley 16031*, 5,000 feet, *Wray & Robinson 5338* (type collection), *Wray's Camp, Ridley 16275*, Seat Point, 5,460 feet, *FMS Mus. 12130* (*Kloss*), Padang, *Corner s.n.*

Known only from Gunong Tahan.

A shrub. Leaves on youngest shoots elliptic or narrowly obovate, narrowed to both ends, apex abruptly acuminate or apiculate; older leaves oblong elliptic or obovate, reaching c. 9 cm.  $\times$  6 cm., apex rounded, shortly apiculate or retuse, base rounded or narrowed, nearly sessile; midrib narrowly channelled above, bold and keeled below; primary nerves up to c. 15 pairs, faint and slightly raised above, faint below, slender, raised, c. 5 mm. apart, joining an intramarginal nerve which is usually hidden by the strongly revolute leaf margin, secondaries and reticulations faint above, secondaries below almost indistinguishable from primaries, reticulations invisible or very faint; upper surface more or less polished, olive green to dark brown

when dry, sometimes pustulate, often gland pitted, lower surface dull, pale brownish to dark brown, usually black dotted.

*Panicles* terminal, dense, up to c. 5 cm. long, peduncle short or almost none, branchlets rather slender, the lower ones up to c. 3 cm. long, the upper shorter, more or less angled with striate bark; *flowers* crowded, *calyx* tube c. 4 mm. long, campanulate, narrowed to a short stout pseudostalk c. 1 mm. long, the centre flower of the groups of three with a slightly longer and more slender pseudostalk than the outer two; calyx lobes broad and shallow but distinct; *petals* falling in a calyptra; *stamens* short, c. 1.5 mm. long, filaments broad at base and tapering upwards, connective gland small and inconspicuous; *style* short, stout. *Fruit* unknown.

38. *Eugenia Wrayi* King, Mat. F.M.P., No. 12, 119 (1901); Ridl., F.M.P., I, 753. (Fig. 20a).

PERAK: Ulu Batang Padang, 4,900 feet, *Wray 1504* (syntype); Gunong Bubu, 5,000 feet, *Wray 3859* (syntype); Gunong Korbu, 5,000 feet, *Haniff 3915* (Ridley's no. 16306), 5,500 feet, *Forest Dept. FMS 31447*.

SELANGOR: Gunong Mengkuang, 5,000 feet, *Robinson s.n.*

PAHANG: Padang, Gunong Tahan, c. 5,500 feet, *Seimund 358*; Gunong Batu Brinchang, 6,700 feet, *SFN 23536* (*Henderson*), *Forest Dept. FMS 36518*; summit of Gunong Irau, *Forest Dept. FMS 36552, 36569*; Cameron Highlands, *Forest Dept. FMS 23836, 25941*; Gunong Benom, 6,900 feet, *Forest Dept. FMS 22335*.

*Distrib*: Endemic.

A shrub or small tree. Youngest twigs 4-angled, dark brown, smooth, older twigs terete with rough greyish bark. Leaves thickly coriaceous, broadly elliptic or elliptic ovate or elliptic obovate to subrotund, up to c. 5 cm.  $\times$  3.5 cm., apex obtuse or retuse or with a very short blunt point, base round, sometimes subcordate, sometimes more or less narrowed; upper surface drying brown to blackish brown, punctate, lower surface paler, reddish brown, black gland dotted; midrib impressed above, broad and hardly elevate below; primary nerves numerous and hardly distinguishable from secondaries and reticulations, ascending to an obscure intramarginal nerve close to the leaf margin; venation above often obscure or invisible, sometimes slightly raised, raised and distinct below, the veins broad and closely reticulate; petiole less than 5 mm. long drying dark.

*Panicles* terminal, short and compact, almost hidden by the leaves, up to c. 2 cm. long and as much across, sessile or shortly pedunculate, branchlets very short and stout, crowded, more or less 4-angled; *flowers* greenish, sessile, usually in threes at branchlet apices, buds shortly globose

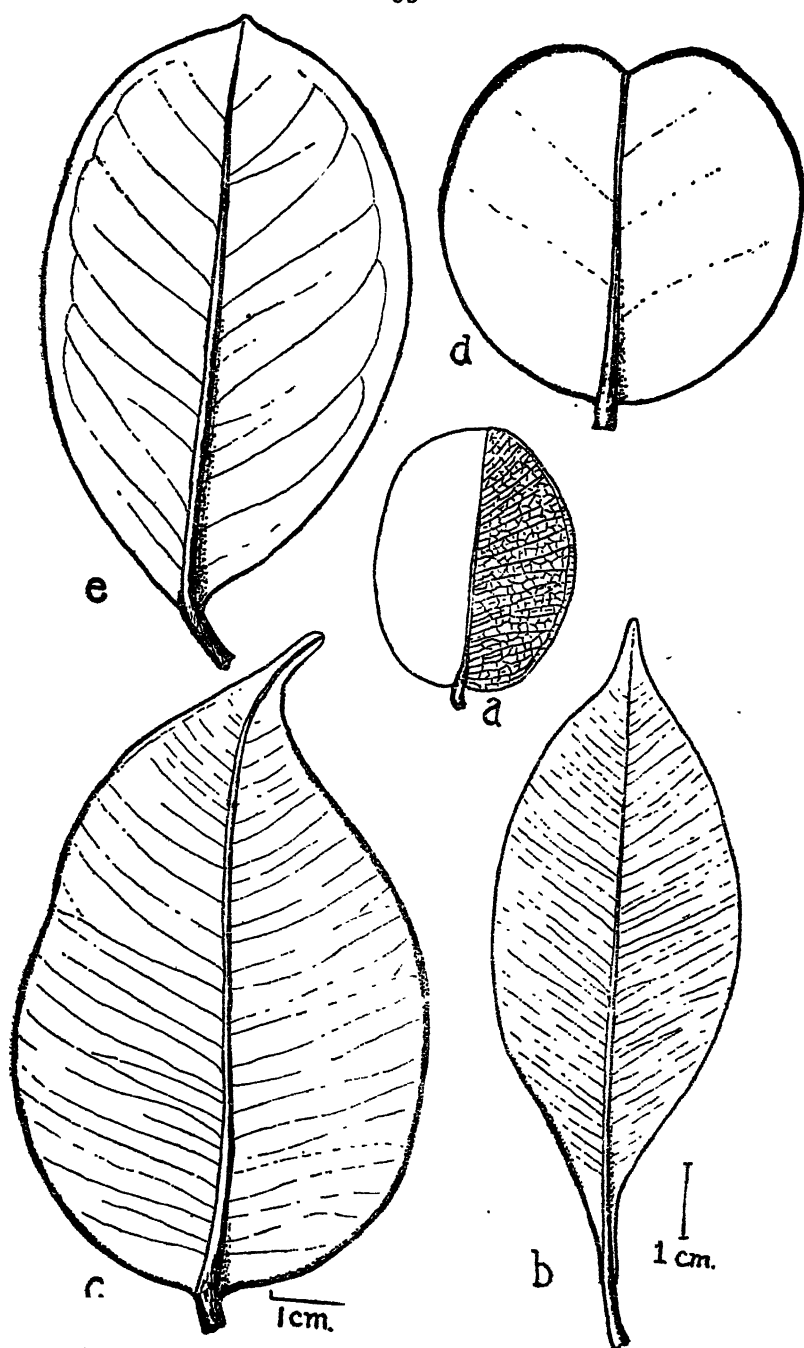


Fig. 20. a, *E. Wrayi*; b, *E. inasensis*; c, d, *E. pahangensis*; e, *E. tahanensis*.  
 Vol. XII. (1949).

clavate; *calyx* tube funnel shaped, c. 5 mm. long, gradually narrowed to base, slightly ridged, gland dotted, the pseudostalk not distinctly marked off; lobes 5, subpersistent, broadly oblong rounded, gland dotted, c. 1.7 mm. across and 1 mm. tall; *petals* free (perhaps falling in a very loose calyptra), orbicular, 2–2.5 mm. diam.; *stamens* numerous, variable in length, reaching c. 5.5 mm., filaments rather stout, subulate, anthers ovate oblong, c. 0.5 mm. long, connective gland rather large; *style* rather stouter than filaments, c. 6 mm. long.

Young fruit globular, crowned by the conspicuous calyx rim and enlarged sepals, the latter disappearing before the fruit ripens. Ripe fruit more or less globose or oblong globose, c. 1 cm. diam., crowned by the short calyx rim, black or blackish brown when dry and wrinkled; pericarp in boiled up fruits smooth, rather thick; seed 1, c. 0.75 cm. diam., testa thick, brown, cotyledons nearly equal, inner faces nearly plane, attached to hypocotyle near their centres by short broad stalks.

39. *Eugenia inasensis* King, Mat. F.M.P., I, No. 12, 120 (1901); Ridl., F.M.P., I, 751. (Fig. 20b).

PERAK: Gunong Inas, 5,000 feet, Wray 4144, 4150, 4154.

Known only from these collections.

A small tree. Twigs rather stout, terete, compressed below nodes, bark nearly smooth, yellowish. Leaves coriaceous, elliptic, or broadly elliptic oblong, sometimes slightly obovate, from c. 5 cm.  $\times$  2 cm. to 10 cm.  $\times$  5.5 cm., apex shortly and abruptly acuminate, base tapered and decurrent on petiole; upper surface more or less polished, drying yellowish brown to blackish brown, closely and minutely punctate, lower surface dull, brownish; midrib impressed above, bold below; primary nerves numerous, slightly raised and inconspicuous on both surfaces, reticulations not visible; petiole channelled above, drying black and wrinkled, up to c. 1 cm. long.

Panicles terminal or from uppermost axils, solitary or clustered, up to c. 4 cm. long, peduncles up to c. 1.5 cm. long, branchlets short, spreading, 2–3 pairs, they and the peduncle rather stout, but thinner than twigs, 4-angled or compressed, with blackish striate bark; flowers white, sessile, in threes at branchlet ends, buds obovoid, 6–7 mm. long; *calyx* after expansion funnel shaped, tapering to base without a distinctly marked pseudostalk, c. 5 mm. long and 4 mm. across mouth; lobes 5, unequal, inconspicuous, the largest transversely oblong ovate c. 2 mm. across and 1 mm. tall; *petals* falling in a calyptra c. 4.5 mm. diam., more or less agglutinated; *stamens* numerous, variable in length,

up to c. 5.5 mm. long, the filaments subulate, stout at base and tapering upwards, anthers ovate oblong, 0.5–0.8 mm. long, connective gland small; style stouter than filaments, c. 5 mm. long; ovary 2-celled. *Fruit* unknown.

Allied to *E. pahangensis* and its variety *Fraseri* rather than to *E. subdecussata* as King suggests.

40. *Eugenia pahangensis* Ridl. in Journ. Linn. Soc., XXXVIII, 307 (1908); F.M.P., I, 751. (Fig. 20c, d).

PAHANG: Gunong Tahan, *Ridley 16015*, 5,000–6,000 feet, *Wray & Robinson 5454* (type collection), Padang, *FMS Mus. 12244*, *12249* (*Kloss*), *SFN 20665* (*Holttum*), 5,300–7,000 feet, *SFN 7936* (*Haniff & Nur*), summit, 7,186 feet, *FMS Mus. 12139*, *Corner s.n.*

*Distrib.*: Endemic.

A small tree, bark greyish pinkish, slightly flaky; inner bark pale pinkish brown. *Twigs* stout, terete, compressed below nodes, bark smooth, whitish, yellowish or pale brown. *Leaves* very coriaceous, elliptic or ovate elliptic to orbicular, from c. 4.5 cm.  $\times$  4.5 cm. to 16 cm.  $\times$  8 cm., apex shortly acute, shortly and abruptly acuminate, rounded, or retuse, base rounded, sometimes subcordate, sometimes shortly and abruptly narrowed to petiole; upper surface drying olivaceous brown to blackish brown, somewhat polished, usually closely and minutely punctate, lower surface dull and paler; midrib impressed above, prominent below and keeled or longitudinally wrinkled; *primary nerves* up to c. 30 pairs, c. 0.5 to nearly 1 cm. apart, spreading, the basal ones often curving downwards, meeting in a nearly straight intramarginal nerve c. 2 mm. from leaf margin, slender and slightly elevate above, and usually quite distinct, varying from slender and elevate below and distinct to invisible, the secondaries and reticulations varying in the same manner; petiole stout, channelled above, drying black and wrinkled, up to c. 1 cm. long.

*Panicles* terminal or occasionally from upper axils, up to c. 6 cm. long and wide, clustered, crowded, usually pedunculate, sometimes sessile, peduncles reaching 3–5 cm. long, very stout, often as stout as twigs, compressed and angled with dark striate bark, smooth in life; branchlets usually two pairs, the lower up to c. 2 cm. long, ascending, the upper shorter and more spreading; *flowers* sessile, crowded at branchlet ends, white or greenish white, disc orange; *calyx* broadly obconic, finely gland dotted, c. 5 mm. long, 4 mm. across mouth, tapered slightly to a broad truncate base or narrowed to a very indistinct pseudostalk; lobes 5, persistent, broadly triangular acute, c. 2 mm. across and 1 mm. tall; *petals* 5, free, slightly unequal, ovate orbicular, the largest c. 3 mm. diam.; *stamens* numerous, variable in

length, reaching c. 6 mm., the filaments rather stout, subulate, anthers oblong, c. 0.8 mm. long, connective gland conspicuous, dark brown; *style* stouter than filaments, 4 mm. long; *ovary* 2-celled with several ovules.

*Fruit* more or less globose, smooth, with one or two well marked or faint vertical ridges, c. 2.5 cm. diam., apical umbilicus rather shallow, c. 5 mm. diam., fringed by the enlarged incurved calyx lobes and bearing the short style remains; pericarp 1–2 mm. thick; cotyledons more or less equal, superposed, smooth with rather conspicuous raised gland dots; inner faces nearly plane, attached to the hypocotyle by very short broad stalks.

***E. pahangensis* Ridl., var. *Fraseri* var. nov.**

A *typa foliis tenuioribus, acuminatis, basi attenuatis, calycis lobis brevioribus differt.*

PAHANG: Fraser Hill, 3,000–4,000 feet, *SFN 3320*<sup>2</sup> (*Corner*),  
TYPE collection, holotype in Herb. Singapore.

The variety here described as new differs from the typical form in the much thinner leaves, narrowed at the base and with an acuminate apex, the more slender twigs and the shorter, smaller, more acute calyx lobes. The collector describes it as a common canopy tree 80 feet or more tall with a heavy crown as in *E. grandis*, the outer bark grey, rather pale, flaking in angular pieces, but not conspicuously, not fissured or ridged, inner bark vinaceous brown; calyx green, disc orange, petals and filaments white, petals calyptrate.

*SFN 33202* was distributed from Singapore as *E. inasensis* King. It is doubtless allied to this species, but differs in the leaves not being pitted above, with more prominent nerves above, and in the different shape of the calyx with smaller, acute, not broad and shallow lobes. More material of the variety, and fruit, may show it to be a distinct species, closely allied to *E. pahangensis* and to *E. inasensis*.

**41. *Eugenia tahanensis* Ridl. in Journ. F.M.S. Mus., VI, 146 (1915); F.M.P., I, 752. (Fig. 20e).**

PAHANG: Gunong Tahan ("top of Tahan"), *Ridley 16032* (type collection), 6,000 feet, *Forest Dept. FMS 42889*, *Corner s.n.*

Known only from Gunong Tahan.

A *shrub* or treelet or dwarf shrub, bark grey or pinkish grey, slightly flaky, inner bark pale brown. *Twigs* very stout, terete, bark pale, the youngest twigs with dark bark. *Leaves* stiff, coriaceous, elliptic or obovate,

up to c. 10 cm. long and 7.5 cm. broad, apex rounded, retuse, or very shortly acute, base more or less narrowed, sometimes rounded and very shortly narrowed on to petiole; petiole up to c. 1.5 cm. long, dark coloured, stout, channelled above; midrib impressed above, raised below; *primary nerves* up to c. 9 pairs, 0.5–1 cm. apart, very fine and channelled above, slender and inconspicuous below in the type but in later collections dark coloured and more conspicuous, no definite intramarginal vein; secondaries and reticulations usually very faint or invisible on both surfaces; in the type both surfaces drying dull brown, the lower paler, in other collections the upper surface polished, dark red brown, the lower dull, paler, upper surface usually minutely punctate.

*Inflorescences* fascicled, terminal or from upper axils, up to c. 7 cm. long; peduncle variable in length, up to c. 4 cm., it and the branchlets compressed and striate; *flowers* crowded at the ends of the very short ultimate branchlets, sessile; *calyx* narrowly obconic, without pseudostalk, c. 5 mm. long, c. 3.5 mm. across mouth, black when dry and wrinkled; lobes 4, incurved in bud, persistent, broadly ovate, rounded, after anthesis the calyx tube campanulate; *petals* united in a thick calyptra; *stamens* numerous, up to c. 1.5 mm. long, filaments broad at base, tapering upwards, anthers broadly elliptic, connective gland rather conspicuous; *style* short.

*Fruit* broadly oblong, c. 1.75 cm. long, smooth, apex without calyx tube, umbilicus shallow, 6–7 mm. diam., fringed with the incurved enlarged calyx lobes and bearing short style remains; pericarp 1–3 mm. thick; seed more or less globose, c. 1.25 cm. diam., testa adhering to cotyledons, somewhat leathery with an outer thin membranous layer and an inner thicker pithy layer; cotyledons more or less equal, side by side, inner faces ridged and furrowed, attached near their centres by short broad stalks to the stout faintly tessellate hypocotyle which reaches the periphery of the seed.

42. *Eugenia Hoseana* King, Mat. F.M.P., No. 12, 106 (1901); Ridl., F.M.P., I, 733. *Syzygium Hoseanum* (King) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 150 (1939). (Fig. 19f).

PERAK: Larut, 300–500 feet, *Kunstler 3407* (syntype); Maxwell's Hill, *Wray 2952* (syntype); Gunong Kledang, *Ridley 9668*; sine loc., *Scortechini 163* (syntype).

JOHORE: Palace Gardens, *Ridley 11989*.

*Distrib*: Borneo.

A tree c. 12 m. tall. *Twigs* terete, compressed below nodes, the youngest quadrangular, bark smooth, pale yellow

or pale greyish yellow. *Leaves* coriaceous, elliptic, elliptic oblong or somewhat obovate, up to c. 15 cm.  $\times$  7 cm., apex abruptly caudate acuminate, base narrowed and decurrent on petiole; upper surface drying dark brown to blackish brown, somewhat polished, minutely punctate, lower surface dull, pale brown, minutely pustulate; midrib impressed above, prominent and rounded below; *primary nerves* 12–20 pairs, 1–1.5 cm. apart, impressed above, prominent below, ascending and running straight or very slightly curved to a well marked looped intramarginal nerve c. 3–5 mm. from leaf margin, with another faint loop much nearer margin; secondaries and reticulations obscure above, the secondaries below distinct but less prominent than primaries, the reticulations lax and faint; petiole less than 1 cm. long.

*Inflorescences* racemose, axillary and terminal, solitary or clustered, short and compact, not exceeding c. 2 cm. long, rachis angled and grooved; *flowers* sessile, white, surmounted and almost hidden by several leathery gland dotted bracts with thin margins, the outer ones ovate acuminate or ovate oblong apiculate, up to c. 9 mm.  $\times$  8 mm., the inner ones oblong ovate or obovate, shorter and blunter; *calyx* 6–7 mm. long, widely campanulate, tapered to base, the pseudostalk usually not distinct, tube wrinkled or more or less ridged below; lobes 5, concave, incurved over petals in bud but not overlapping, erect after anthesis, persistent, oblong, ovate blunt, c. 3 mm. across and 2.5 mm. tall; *petals* 4, falling as a calyptra but not agglutinated and easily separable, orbicular, c. 4.5 mm. diam.; *stamens* numerous, variable in length, up to c. 6 mm. long, filaments subulate, anthers oblong, 0.7–0.9 mm. long, connective gland small but distinct; style stouter than filaments, c. 5.5 mm. long; *ovary* 2-celled.

*Fruit* (? unripe) oblong globose, a little over 1 cm. diam., faintly vertically ridged, apex convex, bearing style remains, fringed by the very short calyx tube and the enlarged incurved calyx lobes; pericarp apparently leathery; seed 1, globose, 7–8 mm. diam., the rather thick crustaceous testa adhering closely to cotyledons; cotyledons unequal, inner faces gland dotted, with a well marked sharp ridge crossing the whole face, the cotyledons attached at the central point of the ridges by short stalks to the long stout hypocotyle which reaches the periphery of the seed.

Distinct in the pale polished twigs, well marked primary nerves, and the very short compact inflorescences with large and conspicuous persistent bracts.

43. *Eugenia variolosa* King, Mat. F.M.P., No. 12, 107 (1901); Ridl., F.M.P., I, 736. (Fig. 21a).

PERAK: Larut, within 10 feet, *Kunstler 3995* (syntype); 500–800 feet, *Kunstler 2796*, 300–800 feet, *Kunstler 3415* (syntype); Gopeng, 500–800 feet, *Kunstler 6036* (syntype); Bikum Reserve, *Forest Dept. FMS 363*; Kledang Saiong Forest Reserve, *Forest Dept. FMS 25312, 33727, 33728*; sine loc., *Scortechini s.n.*

SELANGOR: Kuala Lumpur, *Ridley's collector 4973* (syntype); Sungai Buloh Forest Reserve, *Forest Dept. FMS 457, 2279, 3308*; Weld Hill Forest Reserve, *Forest Dept. FMS 936, 8261, 10341*.

*Distrib*: Endemic.

A shrub or small tree. Young twigs slender, 4-angled, bark brown, copiously pustulate, older twigs terete. Leaves thinly coriaceous, oblong lanceolate or narrowly oblong elliptic, apex caudate acuminate, base cuneate, up to c. 18 cm.  $\times$  6 cm., upper surface drying pale brown to dark brown, pustulate and often also punctate, lower surface paler, pustulate with dark raised glands; midrib impressed above, prominent below and more or less keeled, pustulate; primary nerves up to c. 15 pairs, over 1 cm. apart, very slightly raised and very faint above, raised below, slender but very distinct, ascending, running straight or curving up to a well marked looped intramarginal nerve c. 4–7 mm. from leaf margin, with a much fainter loop c. 2 mm. from margin and a very faint one still closer; secondaries slightly less distinct below than primaries, reticulations lax and very fine; petiole rather slender, channelled above, c. 1 cm. long.

Inflorescences terminal and axillary, racemose, short, clustered, not exceeding c. 2.5 cm. long, rachis pustulate; flowers white, usually pedicelled, pedicels up to c. 5 mm. long or almost none, with a minute broad rounded subpersistent bracteole subtending the flower; buds c. 1 cm. long; calyx narrowly campanulate, tube c. 7 mm. long, conspicuously glandular pustulate, tapered to an obscure pseudostalk less than 1 mm. long; lobes 4, deciduous, conspicuously glandular pustulate, very unequal, the two outer broadly rounded, c. 3 mm. across and 2 mm. tall, the two inner orbicular, c. 5 mm. diam., subpetaloid; petals 4, free, reflexed after anthesis, c. 5.5 mm. long and 5 mm. broad, broadly oblong with large scattered gland dots; stamens numerous, filaments very slender, up to c. 1.5 cm. long, anthers elliptic, c. 0.4 mm. long, connective gland not visible; style slender, but stouter than filaments, c. 2 cm. long.

Fruit globular, smooth, prominently gland dotted, c. 2 cm. diam., apex convex, fringed by the short calyx rim.

Easily recognised by the pustulations on leaves, twigs and flowers, and by the very short inflorescences with narrow flowers and long, very slender stamens.

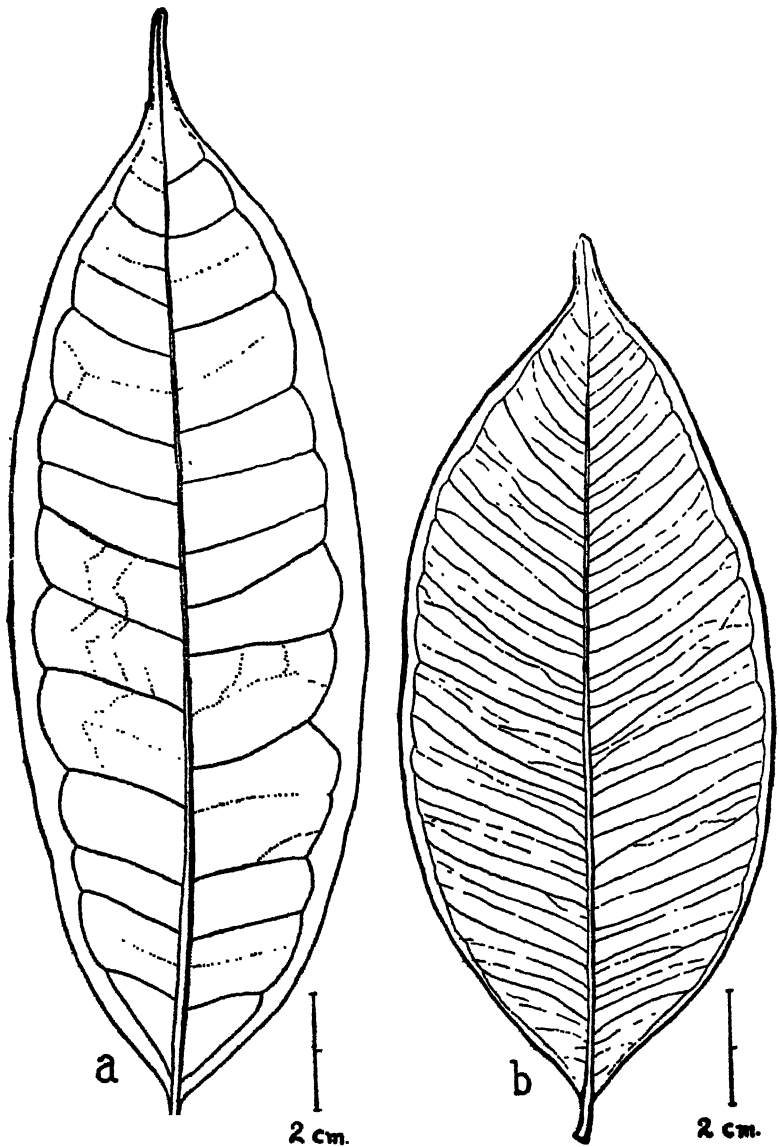


Fig. 21. a, *E. variolosa*; b, *E. chlorantha*.

44. *Eugenia chlorantha* Duthie in Hook. fl., F.B.I., II, 487 (1878), excl. syn.; King, Mat. F.M.P., No. 12, 97; Gagnep. in Fl. Gen. Indo-Ch., II, 806; Ridl., F.M.P., I, 734; Corner, Wayside Trees of Malaya, p. 494, fig. 168. *E. Hullettiana* King, loc. cit., 97 (1901); Ridl., loc. cit., 735. *Syzygium chloranthum* (Duthie) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 173 (1939). (Fig. 21b).

Common in lowland forest from Kedah and Penang (where it is very common on Penang Hill) to Singapore.

*Distrib.* Annam (ex Fl. Gen. Indo-Ch.), ? Siam, Sumatra, Borneo.

A tree reaching c. 24 m. tall, bark smooth, entire, finely lenticellate or finely creviced, sometimes with faint horizontal distant ridges, sepia or salmon colour or dull dark red; inner bark pale brown; wood dark tan yellowish, hard. *Twigs* slender, terete, compressed below nodes, bark smooth, dark brown. *Leaves* thinly coriaceous, elliptic, ovate elliptic or elliptic oblong, occasionally lanceolate, from c. 6.5 cm.  $\times$  2.5 cm. to 19 cm.  $\times$  8.5 cm., apex acuminate or caudate acuminate, base cuneate, upper surface usually drying greenish or brown to blackish brown, minutely pustulate or occasionally punctate, lower surface drying greenish or brownish, closely pustulate; midrib impressed above, elevate below; *primary nerves* numerous, c. 30 pairs, usually 3–5 mm. apart, very fine and slender, slightly raised above and obscure or faint, raised below and distinct, meeting in a fine intramarginal nerve c. 2–3 mm. from leaf margin; secondaries below hardly distinguishable from primaries, reticulations very fine, sometimes invisible; petiole rather slender, up to c. 1 cm. long.

*Panicles* terminal or axillary, up to c. 8 cm. long (up to 14 cm. in fruit), pedunculate or nearly sessile, branchlets rather slender, angled or compressed, usually short but reaching c. 3 cm., spreading-ascending; *flowers* fragrant, greenish white with rose red stamens, or the calyx and petals flushed deep pink, appearing crowded in the shorter inflorescences, usually in threes at branchlet ends, the centre flower on a very short stout pedicel, the others sessile; mature buds c. 1–1.2 cm. long, clavate; *calyx* c. 8 mm. long, c. 6 mm. across mouth after anthesis, contracted just below lobes into a thick, ridged, cylindric or slightly tapering tube 5–6 mm. long; lobes 4 (sometimes 5), spreading-erect, persistent, thick, ovate triangular blunt, 3–4 mm. across base and c. 2 mm. tall; *petals* 4, free, reflexed after anthesis, then deciduous, orbicular with a short thick claw, c. 6 mm. diam.; *stamens* numerous, variable in length, reaching c.

1 cm., filaments subulate, anthers broadly oblong, c. 0.7–0.8 mm. long without connective gland; *style* much stouter than filaments, c. 1 cm. long; *ovary* 2-celled, multiovulate.

*Fruit* subglobose, 1–2 cm. diam., green flushed rose purple, vertically ridged when young, apical excavation deep and narrow, c. 3–4 mm. diam., fringed by the short calyx rim and the upright or reflexed, hardly enlarged calyx lobes.

The only difference that I can detect, in the herbarium, between *E. chlorantha* and *E. Hullettiana* is the larger and more spreading inflorescence of the latter. Kunstler describes the stamens of *E. Hullettiana* as white, slightly red towards centre, while the stamens of *E. chlorantha* are rose red.

Ridley remarks that *E. Hullettiana* is very close to *E. Helferi* but it is really quite distinct from that species both in foliage and flower characters.

45. *Eugenia Ngadimaniana* Henderson in Gardens' Bulletin, Singapore, XI, 305, fig. 4 (1947). (Fig. 22a).

JOHORE: Sungai Kayu, Mawai-Jemaluang road, in swampy forest, SFN 32152 (*Kiah*).

SINGAPORE: Bukit Timah Reserve, altitude under 500 feet, SFN 36129, 37012, 37020 (*Ngadiman*).

A tree c. 20 m. tall, bark pale brown or fawn brown, nearly smooth with fine irregular cracks, scaling in occasional irregular pieces, with irregular longitudinal pits or dimples; inner bark thick, dull red or reddish brown. *Twigs* terete, with dark brown, reddish brown or greyish brown bark. *Leaves* thinly coriaceous, narrowly elliptic or elliptic lanceolate or oblong elliptic, apex abruptly acuminate or caudate acuminate, base long narrowed on to petiole, from c. 6 cm.  $\times$  3.5 cm. to c. 13 cm.  $\times$  5 cm.; upper surface when dry smooth, pale brown to dark brown, lower surface usually paler, with minute slightly raised gland dots; midrib impressed above in a dark coloured channel, raised below; *primary nerves* c. 7–13 pairs, 5–10 mm. distant, slender but distinguishable from secondaries, sunk in narrow channels above, slightly elevate below, meeting in an inconspicuous intramarginal nerve 1–2 mm. from leaf margin; secondaries below nearly as conspicuous as primaries but distinguishable from them, reticulations below usually faint; petiole slender, 1–1.5 cm. long, finely wrinkled.

*Panicles* terminal or from upper axils, solitary or more usually several from each axil or branchlet ends, up to c. 9 cm. long, peduncle 2–5 cm. long with pale longitudinally wrinkled bark; branchlets 2–4 pairs, the lowest up to c. 2 cm. long, the upper shorter, almost horizontal or curving upwards; *flowers* crowded at branchlet ends or at ends of short secondary branchlets, sessile, bracteoles oblong

lanceolate, subacute, subpersistent, c. 1.5 mm. long; buds more or less obovoid, c. 6–6.5 mm. long; *calyx* obconic, 3–4 mm. long, c. 3.5–4 mm. across mouth, without pseudostalk, lobes 5, shallow and broad, acute or subacute, inconspicuous, c. 2 mm. wide and 0.5 mm. tall; *petals* falling in a calyptra but not agglutinated, more or less orbicular, c. 3 mm. diam., conspicuously gland dotted; *stamens* up to c. 8 mm. long, anthers c. 0.2 mm. diam., connective gland inconspicuous; ovary 2-celled with several ovules in each cell.

Ripe fruit dark green slightly flushed dull purplish red at apex, oblong obovoid, obscurely ridged, c. 2 cm. long, apical umbilicus shallow, c. 3 mm. diam., bearing the 5 small incurved calyx lobes and style base; pericarp pithy leathery, c. 2 mm. thick; seed 1, testa thick, whitish pink, brittle crustaceous; cotyledons sessile, superposed, nearly equal, inner faces plane or slightly concave.

46. *Eugenia Helferi* Duthie in Hook. fl., F.B.I., II, 480 (1878); King, Mat. F.M.P., No. 12, 95; Ridl., F.M.P., I, 735. (Fig. 22b, c).

KEDAH: Bukit Dundang Forest Reserve, Forest Dept. FMS 12425.

PENANG: Pulau Jerejak, within 100 feet, *Kunstler* 4181 (one sheet of this number in Herb. Calcutta is so labelled. All the other duplicates that I have seen bear a "Perak, Larut" label. The Penang locality is likely to be the correct one); Waterfall Gardens, *Curtis* 3287, 3827, *Haniff* 1261, *SFN* 21405 (*Henderson*), *SFN* 31575 (*Corner*), *SFN* 37451 (*Nauen*); Government Hill, 500 feet, *Curtis* 212; Penang Hill, *SFN* 35321 (*Kiah*), 2,000 feet, *SFN* 37677 (*Nauen*).

*Distrib*: Burma, Siam.

A tree, trunk fluted at base; bark tessellately creviced into small rectangular pieces, scaling in small patches, not papery flaky, pinkish or greyish brown. Twigs terete or obscurely quadrangular, slender, bark pale brown, reddish brown or greyish, scaly. Leaves coriaceous, narrowly elliptic, elliptic oblong or ovate lanceolate or lanceolate, apex acuminate or acute, base cuneate or long narrowed, from c. 6 cm.  $\times$  1.5 cm. to c. 12 cm.  $\times$  5.5 cm., margin often wavy, thickened and cartilaginous; upper surface drying yellowish green or greenish brown, somewhat polished, lower surface duller and paler usually with black gland dots; midrib flat or very shallowly impressed above, elevate below; primary nerves up to c. 15 pairs in large leaves, spaced, slightly ascending, or more or less horizontal at leaf base, meeting a faint intramarginal nerve close to leaf margin, usually slightly elevate above, very faint or invisible, slightly elevate and faint below, secondaries and reticulations very faint; petiole slender, c. 1 cm. long, the leaf base decurrent upon it.

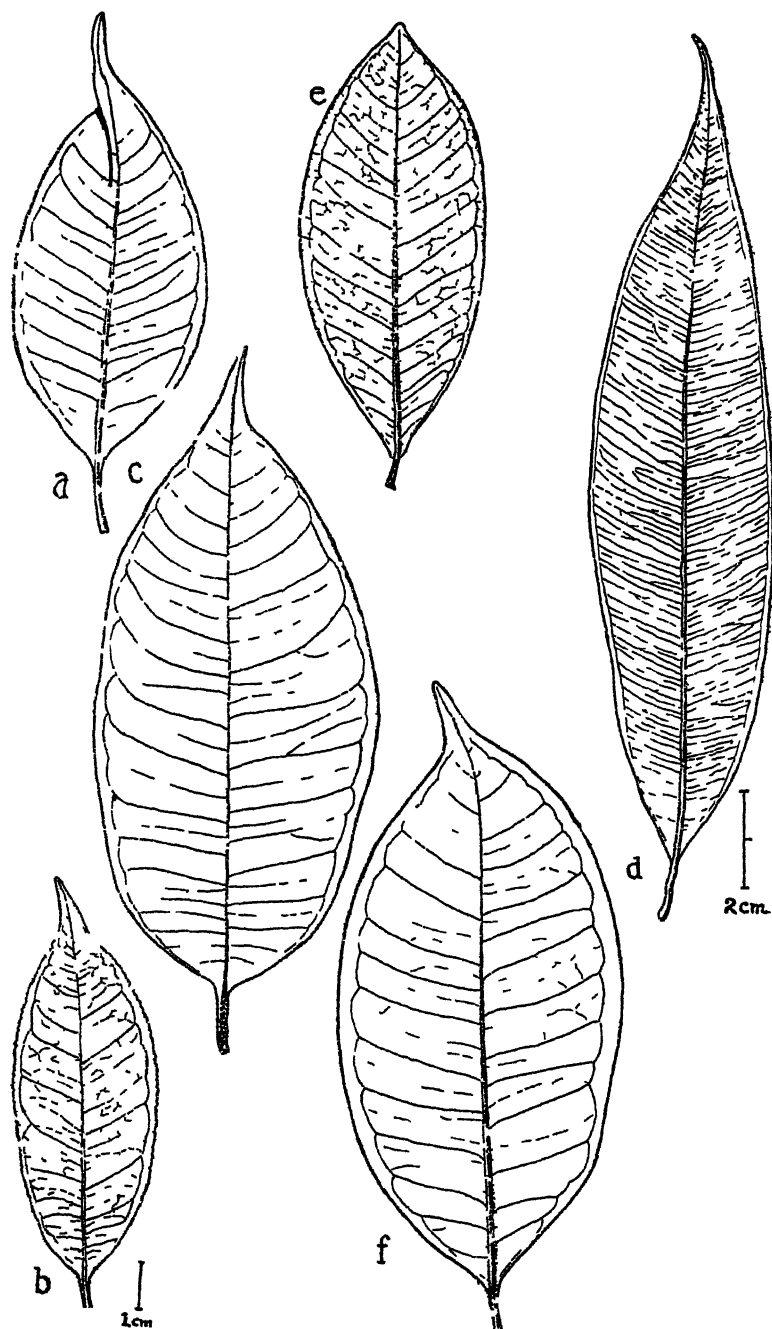


Fig. 22. a, *E. Ngadimaniana*; b, c, *E. Helfer*; d, *E. Græme-Andersonæ*; f, *E. anasosepala*.

*Panicles* terminal or occasionally from uppermost axils, usually solitary, usually less than half length of leaves, but sometimes as long as them, spreading, shortly peduncled, branchlets short and rather crowded, rachis and branchlets with brown scaly flaky bark; *flowers* cream white, fragrant, sessile, usually in threes at branchlet ends, sometimes solitary, nearly 2 cm. across when expanded; buds clavate, 8-9 mm. long; *calyx* tube funnel shaped or narrowly campanulate, glandular, c. 6 mm. long, narrowed at base into a stout pseudostalk c. 1-1.5 mm. long; lobes 4, persistent, unequal, short, broad and rounded, the two outer c. 2-2.5 mm. across and 1 mm. tall, the two inner c. 3 mm. across and 1.5 mm. tall; *petals* 4, free, orbicular, c. 6 mm. diam., conspicuously gland dotted; *stamens* numerous, up to c. 1 cm. long, filaments subulate, slender, anthers oblong c. 0.5 mm. long, connective gland rather conspicuous; *style* much stouter than filaments, c. 6.5 mm. long; *ovary* 2-celled.

*Fruit* oblong or oblong globose, 1.6-2 cm. long and c. 1.5 cm. wide, almost white or pale greenish white with minute pale green dots, crowned by the 4 persistent, incurved, enlarged, fleshy calyx lobes; pericarp firm, not pulpy, sweet, c. 3-4 mm. thick; seed 1, testa adhering to cotyledons, brittle crustaceous; cotyledons conspicuously gland dotted, superposed, inner faces slightly concave, attached to hypocotyle near their centres by short stalks.

The pericarp of the ripe fruit is often partially nibbled away, perhaps by squirrels, the seed being left untouched with testa intact.

47. *Eugenia Graeme-Andersoniae* Ridl. in Journ. F.M.S. Mus., X, 134 (1920); F.M.P., I, 743. (Fig. 22d).

KELANTAN: banks of Chaning river, *Ridley* s.n. (type collection); Sungai Keteh, *SFN 12030* (Nur); Kuala Endong, *SFN 10162* (Haniff); Sungai Galas at Gua Musang, *SFN 22596* (Henderson).

PAHANG: Kuala Tahan, *Seimund* s.n.; Sungai Tahan, *Corner* s.n.

*Distrib:* Endemic.

A small tree with pendent branches. *Twigs* slender, the youngest quadrangular, the older terete and compressed below nodes, bark smooth, pale grey or pale brown. *Leaves* thinly coriaceous, deflexed, narrow oblong lanceolate, up to c. 17 cm.  $\times$  3.5 cm., apex long acuminate, base narrowed; upper surface drying greenish brown to blackish brown, dull, minutely punctate, lower surface paler, minutely glandular pustulate; midrib narrowly impressed above, prominent below; *primary nerves* fine, very numerous and close and parallel, ascending to a fine intra-marginal nerve c. 1 mm. from leaf margin with another

fainter loop very close to the margin; venation usually slightly elevate and visible above and below but more distinct below, the close reticulation visible below but finer than primaries; petiole slender, drying black, up to c. 1 cm. long.

*Inflorescences* axillary in axils of all leaves and terminal, short and erect, not exceeding c. 3 cm. long, branchlets short, angled, with dark bark; *flowers* usually in threes at branchlet ends, sessile, buds narrowly obovoid, 8–10 mm. long; *calyx* funnel shaped before anthesis, somewhat campanulate after, c. 6 mm. long, somewhat ridged, tapering to an obscure or distinct pseudostalk 1–2.5 mm. long; lobes 4, unequal, erect, persistent, the two outer triangular blunt, c. 1.5 mm. across base and 1 mm. tall, the inner ones broadly ovate rounded, c. 3 mm. across and 2 mm. tall; *petals* 4, free or falling in a loose calyptra but not agglutinated, broadly ovate orbicular, c. 4 mm. diam., sparsely but conspicuously gland dotted; *stamens* numerous, up to nearly 1 cm. long, filaments slender, subulate, anthers broadly elliptic, c. 0.4 mm. long, connective gland inconspicuous; *style* stouter than filaments and longer than them.

*Fruit* white when ripe, oblong ovoid, c. 2.5 cm. long and 1.5 cm. across, apical umbilicus deep, 4–5 mm. diam., fringed by the enlarged calyx lobes; pericarp pulpy, rather thick; seed 1, oblong ovoid, c. 1.6 cm. long, cotyledons nearly equal, superposed, gland pitted, inner faces conspicuously gland dotted, one slightly convex, the other slightly concave, attached to hypocotyle near their centres by short broad stalks.

A riverside tree or bush, distinctive in its long narrow deflexed leaves and short erect axillary inflorescences.

48. *Eugenia glauca* King, Mat. F.M.P., No. 12, 102 (1901); Ridl., F.M.P., I, 737.

PENANG: Penara Bukit, Curtis 1152 (syntype); road to Spout, 700 feet, Curtis 2228 (syntype), 2778.

DINDINGS: Lumut, Ridley 3086 (syntype).

MALACCA: Bukit Bruang, Derry 1104 (syntype); Sungai Udang, Derry 1238; sine loc., Griffith K.D. 2416.

JOHORE: foot of Gunong Panti, Corner s.n.

SINGAPORE: Bukit Timah, SFN 33563, 34954 (Corner), SFN 35941 (Ngadiman), SFN 34780, 34789, 35945, 35946, 36180 (Henderson).

*Distrib.*: Endemic.

A tree reaching c. 45 m. tall but usually less, with slight buttresses; bark nearly smooth or longitudinally creviced, or in very large trees slightly fissured, pustulate, scaling off in long irregular pieces, pinkish buff or dull greyish brown to reddish brown; inner bark thick, pale pinkish brown to dark pinkish red. *Twigs* slender, terete,

with brown or red flaky bark. *Leaves* coriaceous, oblong lanceolate, oblong ovate, oblanceolate, obovate or elliptic, variable in size, up to c. 11 cm.  $\times$  5 cm., apex blunt or with a short blunt point, base cuneate; upper surface drying olivaceous or reddish or blackish brown, polished, the lower glaucous in life and usually also when dry; midrib flat above or slightly impressed, or slightly raised and channelled, elevate below; *primary nerves* up to c. 15 pairs, spaced, fine but elevate on both surfaces but more distinct below, ascending rather irregularly to a fine intramarginal nerve c. 1–2 mm. from leaf margin; secondaries and reticulations usually visible above, distinct below and often hardly distinguishable from primaries; petiole drying black, up to c. 6 mm. long.

*Inflorescences* few flowered, terminal and axillary, of clustered racemes or few-branched panicles, up to c. 10 cm. long, rachis and branchlets slender, angled and compressed, with dark striate bark; *flowers* sessile, in threes at ends of branchlets, or solitary, buds globose clavate, 7–8 mm. long; *calyx* after anthesis widely campanulate, c. 7 mm. long and 5 mm. across mouth, narrowed abruptly into a slender pseudostalk c. 3 mm. long; lobes 4, quickly deciduous, rather thick, transversely oblong ovate, c. 3 mm. across and 2 mm. tall; *petals* 4, free, ovate orbicular, rather thick textured, c. 5 mm. diam., reflexed after anthesis; *stamens* numerous, c. 7 mm. long, filaments slender, subulate, broadened at base, anthers oblong elliptic, c. 0.6 mm. long, connective gland inconspicuous; *style* much stouter than filaments, c. 10 mm. long; *ovary* 2-celled with few ovules in each cell.

*Fruit* green when ripe, more or less globose, oblong globose or slightly pyriform, c. 2.5–2.75 cm. diam., faintly vertically ridged, apical umbilicus shallow, c. 4 mm. diam., the calyx rim very short, without calyx lobes; pericarp 2.5–5 mm. thick; seed 1, more or less depressed globose, c. 2 cm. diam., testa rather thick, rather brittle, adhering closely to the smooth shining surface of cotyledons; cotyledons nearly equal, superposed, inner faces pale, gland dotted, nearly plane, sessile, attached to hypocotyle near periphery of seed.

**E. glauca** King var. **pseudoglauca** King, Mat. F.M.P., No. 12, 102 (1901). *E. pseudoglauca* Ridl., F.M.P., I, 737 (1922).

DINDINGS: Lumut, *Ridley 8386* (syntype), *Ridley s.n.*; Pulau Sembilan, *Ridley 3108* (syntype); Pangkor Island, *Curtis 3440* (syntype), *Forest Dept. FMS 10208*; sine loc., *Forest Dept. FMS 1603*.

PERAK: Pulau Lallang, *Seimund s.n.*

JOHORE: Pulau Setindan, off Mersing, *SFN 32232* (Corner).  
*Distrib*: Endemic.

In the herbarium the only distinguishing point between the typical form and the variety is the non-glaucous lower surface of the leaf of the latter. The typical form tends to have less acuminate and more obovate leaves, but there is a great variation in the leaf shape in both forms and some collections of the variety have leaves almost indistinguishable from those of the typical form, except that they are not glaucous. There are, however, certain differences in the barks of the two forms. That of the typical form is described above. The variety has rather deeply irregularly fissured and flaky bark, fawn brown to greyish brown; inner bark brown to purplish-pink-brown.

49. *Eugenia anisosepala* Duthie in Hook. fil., F.B.I., II, 481 (1878), pro parte; King, Mat. F.M.P., No. 12, 96, pro parte; Ridl., F.M.P., I, 736. (Fig. 22f).

KEDAH: Gurun, Forest Dept. FMS 9021.

SELANGOR: Ginting Simpah, Forest Dept. FMS 10246; Ginting Bidai, Ridley s.n.

MALACCA: Sungai Udang Reserve, Derry 289; sine loc., Griffith K.D. 2380, Maingay K.D. 753 in part (type collection).

NEGRE SEMBILAN: Sungai Raya, Forest Dept. FMS 573; Pasir Panjang, Forest Dept. FMS 580.

PAHANG: Kuantan, Forest Dept. FMS 6656.

Distrib: Endemic.

A tree. Twigs slender to rather stout, terete, compressed below nodes, bark smooth, greyish or brownish. Leaves coriaceous, elliptic or oblong lanceolate, up to c. 11 cm.  $\times$  5.5 cm., apex acuminate, base cuneate; upper surface somewhat polished, drying dark brown, sparsely glandular pustulate, lower surface reddish or dark brown; midrib impressed above, prominent below; primary nerves up to c. 14 pairs, spaced, fine and slightly elevate above, fine and usually quite distinct below, curving up to a fairly distinct intramarginal nerve c. 3 mm. from leaf margin; secondaries and reticulations usually visible above and distinct below but finer than primaries; petiole rather slender, up to c. 6 mm. long.

Panicles terminal, corymbose, usually shorter than leaves but reaching c. 10 cm. long, branchlets numerous, spreading-ascending, rather stout, angled and compressed with smooth bark; flowers sessile, usually in threes at the ends of the short ultimate branchlets, rather crowded, buds clavate, c. 8-10 mm. long; calyx more or less campanulate or funnel shaped, nearly 10 mm. long, contracted below into a pseudostalk 3-4 mm. long; lobes 4, unequal, subsistent, the two outer broad and rounded, c. 3 mm. across and 2.5 mm. tall, the two inner subpetaloid, thinner, suborbicular, c. 4-4.5 mm. diam.; petals 4, free, ovate orbicular, c. 4-4.5 mm.

diam.; *stamens* numerous, filaments slender, broadened at base, up to c. 6–7 mm. long, anthers broadly oblong, c. 0.5 mm. long, without connective gland; *style* stouter than filaments, c. 8 mm. long; *ovary* 2-celled. *Fruit* unknown.

Not a very well known species, but distinguishable by its corymbose panicles with rather stout and smooth barked branchlets, and the subpetaloid inner calyx lobes.

*Maingay* K.D. 754 in Herb. Calcutta has been written up by Duthie as *E. anisosepala*. It is *E. Griffithii* Duthie. On the sheet in Herb. Calcutta a pencilled field note reads "a very large tree". This remark is attributed by Duthie to Griffith. There is obviously some confusion in the original diagnosis of the species and also in the Materials, for King cites *Maingay* K.D. 754 as well as *Maingay* K.D. 753 (in part). This latter citation is correct, for the K.D. number was given to two specimens of Maingay's collecting, *Maingay* 1558 which is *E. anisosepala* and *Maingay* 3012 which is *E. laevicaulis* Duthie.

50. *Eugenia Kiahii* Henderson in Gardens' Bulletin, Singapore, XI, 307, fig. 5 (1947).

JOHORE: Sungai Kayu, Mawai-Jemaluang road, SFN 32036 (*Kiah*), SFN 29400 (*Corner*).

Known only from these collections in the fresh water swamp forests of South Johore.

A tree c. 12 m. tall, twigs stout, terete, with smooth, sometimes polished, grey brown or pale brown or greyish white bark. *Leaves* very coriaceous, ovate or orbicular, broadly ovate oblong, broadly elliptic, or elliptic oblong, up to c. 10 cm. long and 9 cm. broad, base very shortly cuneate, or rounded and very shortly and abruptly narrowed on to petiole, apex rounded or shortly and bluntly acute or apiculate; petiole c. 1 cm. long; midrib impressed above, elevate below; *primary nerves* fine, raised on both surfaces, slightly less conspicuous above than below, about 7–10 pairs, meeting in an intramarginal loop 3–5 mm. from margin, secondaries and reticulations raised on both surfaces and almost as distinct as primaries.

*Inflorescences* short and dense, terminal, on stout peduncles c. 2.5 cm. long; peduncles and rachis as stout as twigs, more or less compressed, secondary branchlets also stout and angled, c. 1.5 cm. long, the flowers crowded at their apices or on tertiary branchlets c. 3 mm. long. *Flower* buds obovoid, c. 7–8 mm. long, *calyx* narrowly campanulate, narrowed rather abruptly to a stout pseudostalk; calyx tube including pseudostalk 5–6 mm. long, lobes 5, distant, triangular ovate blunt, c. 1 mm. tall; *petals* calyptrate,

leathery; *stamens* 3.5–4 mm. long, anthers c. 0.4 mm. diam., connective gland dark brown, conspicuous; *ovary* 1-2-locular, multiovulate; *fruit* unknown.

A species characterised by the broad thick leaves with well marked venation and the stout densely flowered panicles.

***E. Kiahii* Henderson var. *angustifolia* var. nov. (Fig. 23).**

A *typa foliis tenuioribus, angustioribus, inflorescentiis maioribus, ramis paniculae gracilioribus, floribus leviter minoribus differt.*

JOHORE: Sungai Sedili, *SFN 36921 (Ngadiman)*, TYPE collection, holotype in Herb. Singapore; Pengkalan Raja peat forest, Pontian, *SFN 36668 (Ngadiman)*.

At first sight this variety looks very different from typical *E. Kiahii* in the narrower leaves drying paler, the larger inflorescence with much more slender branchlets, and in the slightly smaller flowers, but the flowers correspond closely in shape and structure with those of the typical form, and the venation in both forms is very similar. *SFN 36668* from the peat forest at Pontian is in very young fruit, the flowers having lost their petals and stamens and the ovary beginning to swell up. The inflorescence branchlets of this collection are appreciably stouter than those of the type, and the flowers apparently not so crowded.

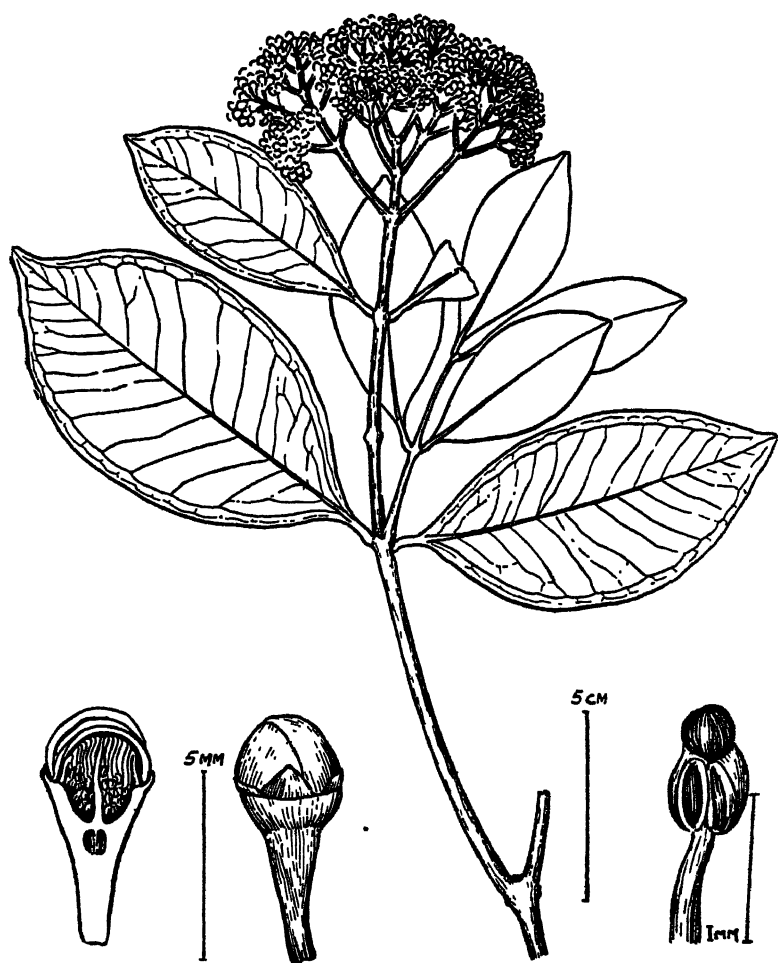
According to the field note the type collection of the variety is a tree of 90 ft. tall, stilt-rooted ("jangkang"), flowers white. A small bark specimen shows a smooth dull red or greyish brown bark about 5–6 mm. thick with the outer layers thinly papery flaky.

**51. *Eugenia Burkilliana* King, Mat. F.M.P., No. 12, 94 (1901); Ridl., F.M.P., I, 735. (Fig. 24c).**

PERAK: Asam Kumbang, *Wray 2785* (syntype); Taiping, *Wray 3070* (syntype); Gopeng, 500–800 feet, *Kunstler 4719* (syntype), 800–500 feet, *Kunstler 6186* (syntype).

*Distrib:* Endemic.

A tree up to c. 18 m. tall. *Twigs* terete or obscurely quadrangular with raised lines on the angles, bark nearly smooth, or striate, brownish or blackish brown. *Leaves* coriaceous, oblong lanceolate, up to c. 10 cm. × 3.5 cm., apex acuminate, base cuneate; upper surface drying greenish brown or pale brown, somewhat polished, minutely and closely punctate, lower surface about the same colour, with raised black gland dots; midrib impressed above, elevate below; *primary nerves* about 10 pairs, fine, spaced, ascending, meeting in a rather irregularly looped intra-marginal nerve 3–5 mm. from leaf margin, with another

Fig. 23. *E. Kiahi* var. *angustifolia*.

Del: CHAN YOEK CHYE.

much fainter one about 1 mm. from margin; secondaries and reticulations quite distinct but distinguishable from primaries; all the venation elevate and distinct on both surfaces; petiole slender, up to c. 1.2 cm. long.

*Panicles* terminal, almost or quite sessile, much branched from near base, many flowered, c. 4 cm. long and 6 cm. diam., branchlets ascending, 4-angled and compressed, with brown bark, the primary branchlets rather stout, the secondary thinner; *flowers* white, in threes at ends of short

tertiary branchlets, the outer flowers of the triads usually shortly pedicellate and the centre one sessile, buds clavate, c. 1 cm. long; *calyx* funnel shaped, 8–10 mm. long, striate, c. 4 mm. across mouth, gradually narrowed to a pseudostalk c. 3 mm. long; lobes 4, persistent, slightly unequal, bluntly rounded triangular, the larger c. 3 mm. across and 2 mm. tall, thick textured, sparsely but conspicuously gland dotted; *petals* 4, free, orbicular, 4–4.5 mm. diam., thin textured, with a few large gland dots; *stamens* numerous, up to c. 11 mm. long, filaments slender, subulate, anthers very small, ovate, c. 0.3 mm. long, connective gland conspicuous; *style* considerably stouter than filaments, c. 4.5 mm. long. *Fruit* unknown.

The following fruiting specimen may belong here. It differs in having a longer and laxer inflorescence and paler bark on the twigs:

PERAK: Kota, Wray 1954.

*E. Burkilliana* King var. *garcinifolioides* var. nov. (Fig. 24a).

A *typa* inflorescentibus laxioribus longioribusque, foliis multo maioribus (ad 18 cm. longis et 8.5 cm. latus) distinguenda.

PAHANG: Rompin, Forest Dept. FMS 15421, TYPE collection in Herb. Kepong.

*Distrib*: Endemic.

This variety has exactly the leaves of *E. garcinifolia* King, but the flowers are those of *E. Burkilliana*.

52. *Eugenia Duthieana* King, Mat. F.M.P., No. 12, 103 (1901); Ridl., F.M.P., I, 731. (Fig. 25a).

In hill forest in Kedah, Penang and Perak, up to 4,300 feet, and in lowland forest in the south of the Peninsula from Malacca and Pahang to Singapore. Endemic.

A tree up to c. 21 m. tall, trunk very slightly fluted at base or narrowly buttressed to c. 1.5 m.; bark smooth or pustulate over large areas or with longitudinal crevices, flaking in long pieces, pale reddish brown to warm brown; inner bark rather thick, fibrous and dimpled where exposed by stripping of outer layers, sometimes with a green layer immediately below outer layer, reddish brown or reddish buff; wood pale buff. *Twigs* rather slender, terete, with brownish or greyish somewhat flaky bark. *Leaves* coriaceous, elliptic, elliptic lanceolate or ovate elliptic, apex acuminate or caudate acuminate, base cuneate, up to c. 15 cm. × 6.5 cm., upper surface drying dull, pale brown to blackish brown, smooth, lower surface brown or reddish brown, usually paler than upper; midrib narrowly impressed

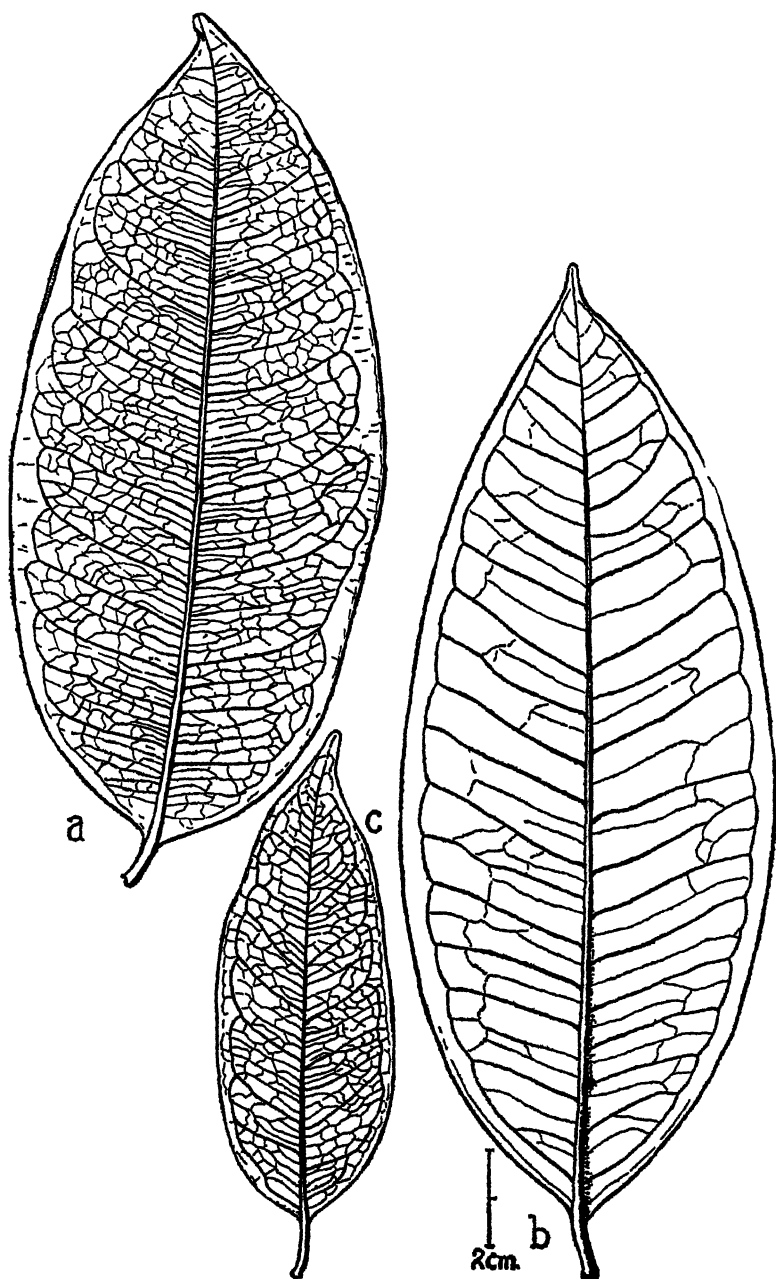


Fig. 24. a, *E. Burkkilliana* var. *garcinifolioides*; b, *E. Griffithii*; c, *E. Burkkilliana*.

above, elevate below; *primary nerves* up to c. 8 pairs, 1-2 cm. apart, impressed above and very faint, slender but elevate and distinct below, ascending and curving slightly up to a well marked intramarginal nerve far from leaf margin (4-7 mm.), with a much fainter loop closer to margin; secondaries and reticulations very faint or invisible above, slightly raised below but much less distinct than primaries; petiole c. 5-7 mm. long, the leaf blade decurrent upon it.

*Inflorescences* terminal, of clustered or solitary racemes up to c. 7 cm. long, the rachis slender, 4-angled, with black bark; *flowers* white, few, sessile, one or two pairs of flowers on the rachis with 3 or sometimes 5 terminal ones, buds clavate, c. 7 mm. long; *calyx* after anthesis rather widely funnel shaped, c. 5 mm. long, ridged, tapered to a pseudostalk c. 1.5 mm. long; lobes 4, subpersistent, broadly ovate rounded, c. 2-3 mm. across and 1.5-2 mm. tall; *petals* 4, free, orbicular, rather thick textured with thin margins, c. 3 mm. diam.; *stamens* numerous, filaments slender, subulate, up to 5-6 mm. long, anthers oblong elliptic, c. 0.5 mm. long, connective gland small; *style* much stouter than filaments, c. 7 mm. long; *ovary* 2-celled.

*Fruit* globular or slightly pyriform, c. 2 cm. long, rugulose when dry, apical umbilicus wide and shallow, c. 5 mm. diam., with the exceedingly short calyx rim without remains of calyx lobes; pericarp very thick, seed 1, more or less globose, inner cotyledon faces nearly plane, attached to hypocotyle by short stalks.

53. *Eugenia Griffithii* Duthie in Hook. fil., F.B.I., II, 481 (1878); King, Mat. F.M.P. No. 12, 92; Ridl., F.M.P., I, 731. *Syzygium Griffithii* (Duthie) Merr. and Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 174 (1939). *E. Valetoniana* King, Mat. F.M.P., No. 12, 112 (1901). *E. subrufa* King, Mat. F.M.P., No. 12, 102 (1901), et var. *robusta* King, loc. cit., 103; Ridl. F.M.P., I, 733. (Fig. 24b).

Rather widely distributed in lowland and hill forest from Penang to Singapore.

*Distrib.*: Borneo.

A tree up to c. 24 metres tall, bark greyish or pale pinkish greyish buff, slightly cracked or creviced; inner bark pinkish. *Twigs* slender, terete, with brown and rather flaky bark. *Leaves* coriaceous, narrowly elliptic or oblong elliptic, apex acute or shortly acuminate, base broadly or narrowly cuneate, up to c. 19 cm. long and 7.5 cm. broad, purple when young; upper surface drying brown to blackish brown, more or less polished, often punctate, lower surface brown; midrib impressed above, elevate below; *primary*

nerves up to c. 15 pairs, 1-1.5 cm. apart, spreading ascending, meeting a distinct intramarginal nerve c. 3-5 mm. from leaf margin, impressed or slightly elevate or very obscure above, usually prominent below, sometimes rather fine and faint, secondaries below usually distinct but much finer than primaries, reticulations very fine to almost invisible; petiole up to nearly 1 cm. long.

*Inflorescences* rather variable, terminal or axillary, often clustered, of lax racemes or panicles, reaching c. 17 cm. long but usually much less, rachis and branchlets slender, dark coloured, compressed and angled; the racemes with distant clusters of flowers, the panicles with distant slender branchlets up to c. 3 cm. long, the flowers clustered at their ends; *flowers* sessile, white or pale green with white stamens, buds globose clavate c. 1 cm. long; *calyx* rather narrowly campanulate, c. 1 cm. long, rather abruptly narrowed into a pseudostalk more than half its length; lobes 4, unequal, deciduous, the two outer thick textured, very broad and rounded, c. 3 mm. across and 1.5 mm. tall, the two inner thinner, subpetaloid, gland dotted, overlapping in bud, c. 4.5 mm. across and 3 mm. tall; *petals* 4, free, ovate orbicular, sparsely but conspicuously gland dotted, 4-5 mm. diam.; *stamens* numerous, filaments slender, subulate, up to c. 7 mm. long, anthers elliptic oblong, c. 0.6 mm. long, connective gland small; *ovary* 2-celled.

*Fruit* more or less globose, c. 2 cm. diam., corrugate-rugulose when dry, apical umbilicus c. 4 mm. diam., fringed by the very short calyx rim, without calyx lobes; pericarp very thick, seed 1, cotyledons side by side, nearly equal, inner faces gland dotted, nearly plane, attached to the hypocotyle near their centres by short stalks.

The material which I have placed here constitutes perhaps an assemblage of plants rather than a well marked species. The material available is not very good and the description has been made from sheets which match most closely the type. *E. Griffithii* is perhaps nearest to *E. Duthieana* but differs in the leaves being longer in proportion to their width, with more primary nerves, in the tendency of the inflorescence to branch and become paniculate and in the longer pseudostalk of the calyx.

54. *Eugenia Thumra* Roxb., var. *penangiana* King, Mat. F.M.P., No. 12, 92 (1901); Ridl., F.M.P., I, 734. (Fig. 25b).

PENANG: Highlands, *Curtis* 3601; Waterfall, *Curtis* 2410 (type collection); Penang Hill, *Nauen* s.n.

A medium sized tree. *Twigs* slender, quadrangular or more or less terete with raised lines between the nodes, bark

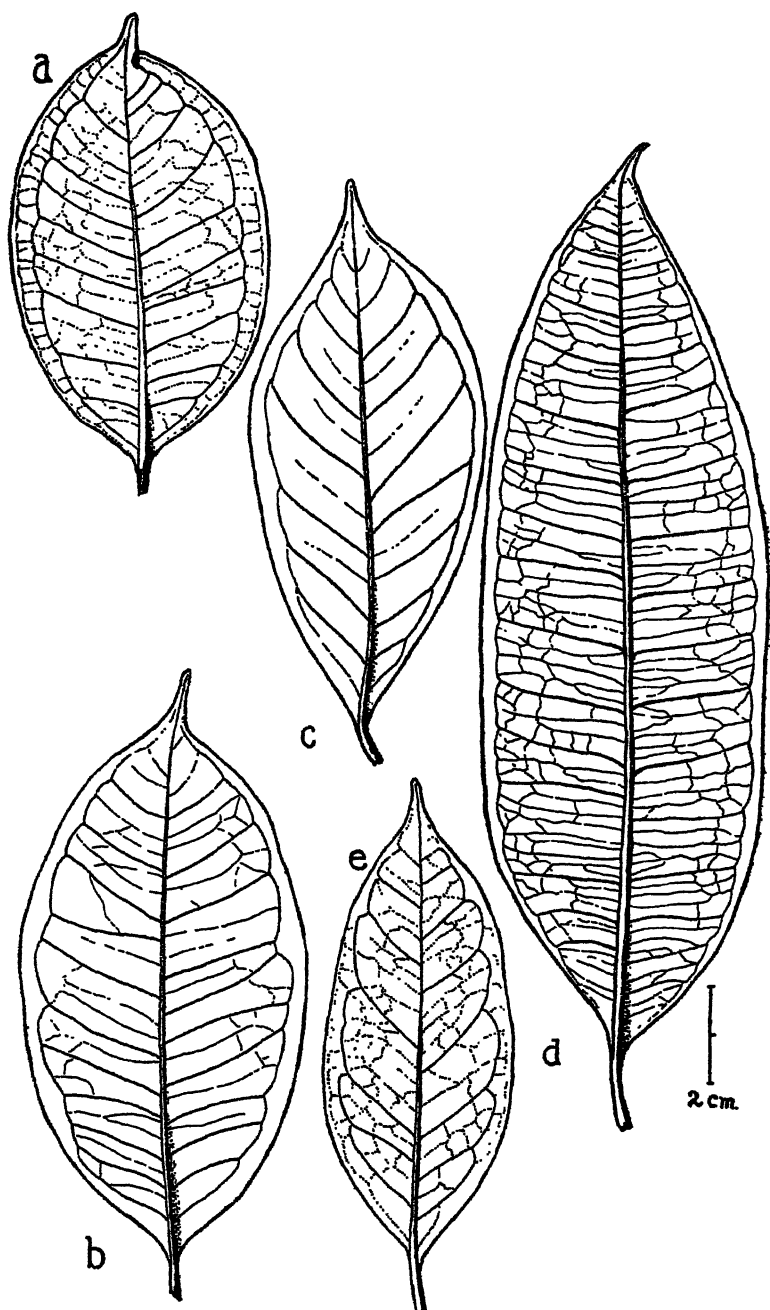


Fig. 25. a, *E. Duthieana*; b, *E. Thumra* var. *penangiana*; c, *E. Swettenhamiana*; d, *E. subhorizontalis*; e, *E. Ridleyi*.

of youngest shoots dark and smooth, that of older parts brownish or greyish, rough. *Leaves* coriaceous, elliptic, oblong elliptic, or oblong lanceolate, up to c. 13 cm.  $\times$  6 cm., apex acute or subacute or shortly and abruptly acuminate, base cuneate and narrowed on to petiole; upper surface drying lead brown to blackish brown, dull, minutely pustulate, lower surface dark brown, closely pustulate; midrib narrowly impressed above, prominent below and pustulate; *primary nerves* 8-9 pairs, finely impressed and faint above, rather prominent below, ascending and curving up slightly or running straight to a well marked shallowly looped intramarginal nerve c. 4-5 mm. from leaf margin, with an exceedingly faint series of loops close to the margin; secondaries and reticulations invisible above, secondaries below not so prominent as primaries, reticulations lax and very faint; petiole rather stout, drying black and wrinkled, c. 1 cm. long.

*Panicles* terminal and axillary, clustered or solitary, peduncled, up to c. 14 cm. long, branchlets 1-3 pairs, spreading, slender, they and the rachis 4-angled or compressed; *flowers* white, clustered at ends of branchlets, or at ends of shorter secondary branchlets; buds globose clavate, 5-6 mm. long; *calyx* funnel shaped, c. 5 mm. long, more or less ridged, contracted rather abruptly into a pseudostalk c. 2.5 mm. long; lobes 4, ?subpersistent, very unequal, the two outer thick, broad, rounded, c. 2 mm. across and 1 mm. tall, the two inner subpetaloid, overlapping in bud, thin, broadly ovate orbicular retuse, c. 4 mm. diam.; *petals* 4, free, ovate orbicular or ovate triangular, c. 4 mm. across; *stamens* numerous, up to c. 6 mm. long, filaments slender, subulate, wrinkled, anthers broadly oblong or oblong elliptic, 0.5-0.6 mm. long, connective gland conspicuous; *style* much stouter than filaments, c. 5 mm. long; *ovary* 2-celled. *Fruit* unknown.

I have seen no authentic material of *E. Thumra* Roxb., and so have accepted King's placing of our plant. I have examined a series of specimens placed under *E. Thumra* in Herb. Dehra Dun and these agree well with our plant in inflorescence and flower characters but differ in having the primary nerves raised above, not sunk, and in the terete twigs without raised lines between the nodes. Our plant appears close to *E. Griffithii* Duthie and *E. Ridleyi* King but differs from both in the venation and in having raised lines on the twigs, and from the former in the larger and more branched inflorescence and smaller flowers.

55. *Eugenia Swettenhamiana* King, Mat. F.M.P., No. 12, 126 (1901), pro parte, emend. (Fig. 25c).

PERAK: near Gunong Pondok, 500-800 feet, *Kunstler* 7590 (lectotype).

*Arbor* 18-21 m. alta. *Ramuli* tereti, cortice pallide fusco. *Folia* oblanceolata, 10-11 cm. longa, c. 4 cm. lata, apice breviter et obtuse acuminata, basi sensim ad petiolum attenuata; costa media supra impressa subtus prominente, *nervis primariis* utrinque c. 6-8, supra impressis, subtus prominulis, inter se c. 1 cm. distantibus, vena intramarginali a margine 3-5 mm. remota conjunctis; petioli 5-6 mm. longi. *Paniculae* terminales, 2-4 fasciculatae pedunculatae, 5-8 cm. longae, ramulis laxis ad 1 cm. longis. *Flores* in apice ramulorum 3 vel 1, sessiles vel pedicellati. *Calycis* tubus infundibuliformis, brevistipitatus, ad 4 mm. longus, lobis 4 late rotundis c. 2 mm. diam. *Petala* 4, libera, calycis lobis sub-aequalia.

King included two distinct species here and one of them, represented by Scortechini's collection, was redescribed by Ridley as *E. cordifoliata*. Ridley, in a note in F.M.P., I, p. 755, points out that King's species is a mixture and that the portion that he rejects does not appear to be a Myrtaceous plant (there is an obvious *lapsus calami* in this note, for Ridley refers to Scortechini's plant when he means that collected by Kunstler).

Kunstler's specimens are certainly not good, the flowers being in bud and somewhat crushed, but enough of the structure can be made out to be certain that they represent a species of *Eugenia* which has the same shape of calyx tube and the same large rounded sepals and free petals as *E. cordifoliata*. The latter, however, has larger flowers and leaves with cordate, not narrowed bases.

King's description was based mostly on Kunstler's specimens, but also to some extent on Scortechini's, and a new description has therefore been made.

56. *Eugenia subhorizontalis* King, Mat. F.M.P., No. 12, 112 (1901); Ridl., F.M.P., I, 733. (Fig. 25d).

PERAK: Asam Kumbang, *Wray* 2118 (syntype); Taiping, *Wray* 2097 (syntype).

NEGRI SEMBILAN: Sungai Raya, *Forest Dept. FMS* 573.

*Distrib*: Siam, Bangka, Sumatra (fide King).

A small tree. *Twigs* slender, terete, smooth, blackish brown when dry. *Leaves* thinly coriaceous, oblong or elliptic oblong, apex shortly acuminate, base cuneate and decurrent on petiole, margins more or less recurved, 8-18 cm. long and 3-5-6 cm. broad, upper surface drying olivaceous to blackish brown, somewhat polished, lower surface

brown or reddish brown, dull; midrib impressed above, prominent below: *primary nerves* up to c. 20 pairs 0.5–1 cm. apart, very fine and impressed above, fine below but elevate and distinct, subhorizontal, curving slightly up to a distinct intramarginal nerve c. 2–4 mm. from leaf margin; secondaries and reticulations very faint above, slightly impressed, elevate below and rather distinct; petiole up to c. 1.5 cm. long.

*Panicles* terminal and axillary, lax, up to c. 8–9 cm. long, branchlets few, distant, spreading-ascending, slender and compressed with dark striate bark; *flowers* white, sessile, in clusters of 3–6 at branchlet ends, not crowded, buds globose clavate to obovoid, c. 8–10 mm. long; *calyx* funnel shaped, 6–8 mm. long, narrowed at base to a pseudostalk 2–3 mm. long; lobes 4, nearly equal, broad and rounded, c. 2 mm. across and 1 mm. tall; *petals* calyptrate, more or less agglutinated; *stamens* numerous, filaments slender, subulate, c. 5 mm. long, anthers oblong, c. 0.5 mm. long, connective gland inconspicuous; *style* stout at base, tapering upwards, c. 4 mm. long. *Fruit* unknown.

No expanded flowers of this species have been seen and the material available is scanty. The subhorizontal primary nerves and the lax and rather long inflorescences with slender branchlets are distinguishing points.

57. *Eugenia Ridleyi* King, Mat. F.M.P., No. 12, 98 (1901); Ridl., F.M.P., I, 735; Corner, Wayside Trees of Malaya, p. 503, fig. 168. (Fig. 25e).

Widely distributed from Kedah to Singapore but apparently nowhere very common except in Singapore.

*Distrib.*: Siam (fide Craib).

A *tree* up to c. 30 m. tall, without buttresses; bark irregularly fissured, flaking in thick irregular pieces, not papery flaky, light brown or buff-red; inner bark thick, fibrous, dark red with dark red sap; wood rather soft, pale buff. *Twigs* slender, terete, the youngest with smooth, almost black bark, the older with greyish or brownish smooth or slightly rough bark. *Leaves* deep blue when young, thinly coriaceous, ovate lanceolate or oblong lanceolate, apex acuminate, base cuneate, from c. 8 cm.  $\times$  3 cm. to 18 cm.  $\times$  6 cm.; upper surface dull, drying dark brown to blackish brown, minutely punctate, lower surface paler brown, sometimes glandular pustulate; midrib impressed above, prominent below; *primary nerves* 6–10 pairs, 1–2 cm. apart, very slightly raised and channelled above, faint, prominent below, ascending and curving upwards to form a well marked looped intramarginal nerve c. 4–10 mm. from leaf margin, with a very faint loop close to margin,

secondaries below almost as prominent as primaries, reticulations lax, usually very faint; petiole usually c. 1 cm. long.

*Panicles* terminal and axillary, often clustered, up to c. 8 cm. long, usually shortly peduncled, branchlets distant, 2-3 pairs, spreading, they and rachis slender, angled and compressed, with dark bark; *flowers* clustered at branchlet ends, buds globose clavate, c. 7 mm. long and 6 mm. across; *calyx* broadly funnel shaped, abruptly tapered to a pseudostalk 1-2 mm. long, green with minute pale gland dots; lobes 4, pale green, broadly ovate rounded, c. 4 mm. across at base and 2 mm. tall, reflexed after anthesis, persistent; *petals* 4, falling as a calyptra but not agglutinated and very easily separable, pale green with paler margins, more or less orbicular, c. 4 mm. diam.; *disc* green with thickened corrugate inner margin; *stamens* numerous, filaments slender, subulate, green, c. 5 mm. long, anthers very small; *style* subulate, green, stouter than filaments, c. 5 mm. long, tapering upwards from a stout pale conical base; *ovary* 2-celled with several ovules in each cell.

*Fruit* when ripe dull green slightly flushed brownish red, globose or ovoid, occasionally somewhat obovoid, up to c. 2 cm. diam., apical umbilicus shallow and wide, c. 8-9 mm. diam., with the 4 incurved somewhat enlarged and fleshy broad blunt calyx lobes on its margin, and style base; pericarp white, fleshy, slightly juicy, slightly sweet, c. 3 mm. thick; seed more or less globular, c. 1.5 cm. diam., testa pale green, thick, pithy and juicy, adhering strongly to the irregular surface of the cotyledons; cotyledons pale green, more or less equal, stalked, hypocotyle large, cylindrical, pink, lying in a groove and reaching almost to the periphery of the seed.

The green flowers and deep blue young leaves make this species a distinct one in the field.

58. *Eugenia Dyeriana* King, Mat. F.M.P., No. 12, 88 (1901), et var. *oblonga* King, loc. cit.; Ridl., F.M.P., I, 732. *E. Clarkeana* King, loc. cit., 93. *E. corrugata* King, loc. cit., 93; Ridl., F.M.P., I, 732. (Fig. 26).

Common from Kedah to Johore in lowland and hill forest, common in Perak from sealevel to 4,000 feet, and in hill forest at Cameron Highlands, Pahang.

*Distrib.*: Lower Siam.

A tree up to c. 22 m. tall. *Twigs* rather stout, terete, smooth, bark brownish or greyish, the youngest shoots compressed, with dark bark. *Leaves* thickly coriaceous, elliptic, elliptic oblong or oblong, apex acute or shortly and abruptly acuminate, base cuneate or abruptly narrowed on to petiole, usually large, up to c. 26 cm.  $\times$  10 cm., upper

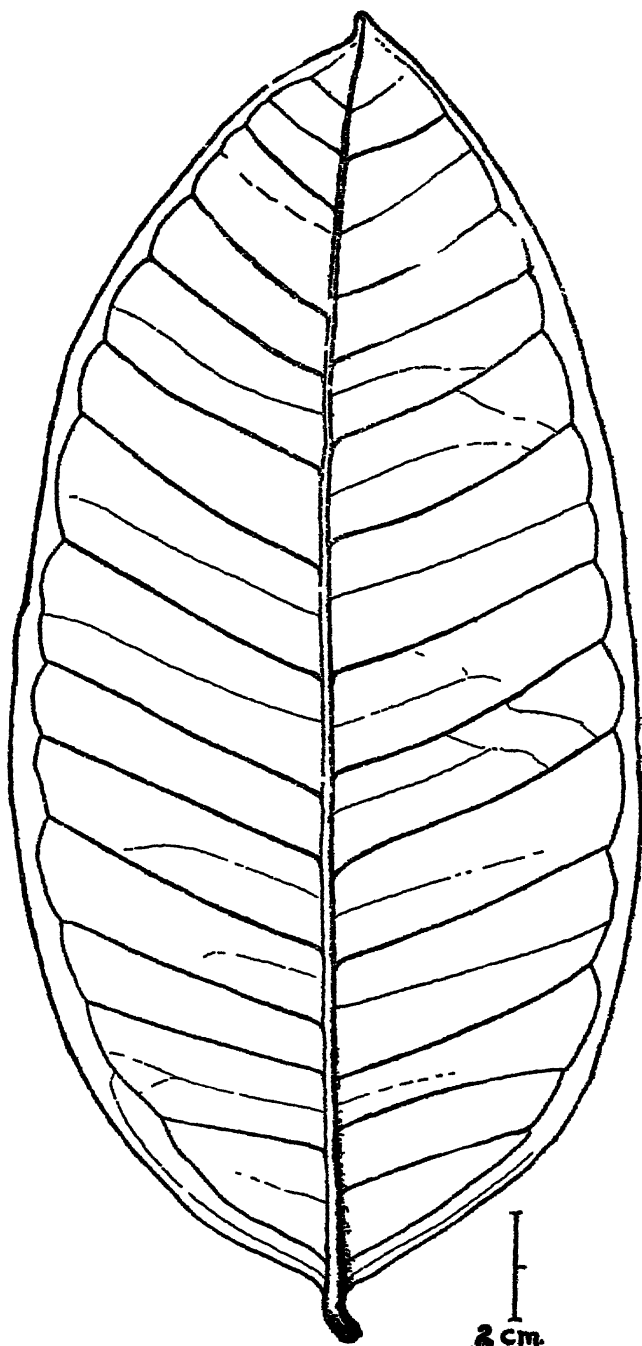


Fig. 26. *E. Dyeriana*.

surface drying dark to blackish brown, more or less polished, sometimes minutely punctate, lower surface warm red brown, more or less shining; midrib shallowly impressed above, prominent and rounded below; *primary nerves* up to c. 20 pairs, spaced, impressed above, often inconspicuous, bold below and drying dark, ascending and running straight or curving up to a bold shallowly looped intramarginal nerve 4–6 mm. from leaf margin; secondaries and reticulations usually very faint or invisible above, faint below, but if distinct, always much less prominent than primaries; petiole stout, up to c. 1 cm. long, widely channelled above.

*Panicles* terminal or axillary, often clustered, variable in length but nearly always shorter than leaves, reaching 15 cm., but usually not more than 9–10 cm., usually pedunculate, rachis usually rather stout, 4-angled, with dark bark, bearing usually about 2 pairs of short stout compressed, spreading and distant branchlets; *flowers* crowded at branchlet ends, sessile, buds obovoid, c. 7 mm. long; *calyx* after anthesis widely funnel shaped, c. 6 mm. long, slightly contracted near base into a very stout obscure pseudostalk; lobes 4, deciduous, unequal, the outer two very thick textured, transversely oblong, c. 5 mm. broad and 3 mm. tall, inners subpetaloid, thinner textured, suborbicular, c. 5 mm. diam.; *petals* 4, free, orbicular, c. 6 mm. diam., gland dotted; *stamens* numerous, filaments slender, subulate, reaching c. 1 cm., anthers elliptic or oblong elliptic, almost 1 mm. long, connective gland conspicuous; *style* stouter than filaments, c. 7 mm. long; *ovary* 2-celled, multiovulate.

*Fruit* globular to depressed globular, smooth or vertically ridged or corrugate, up to c. 6 cm. diam., apical umbilicus small, with a very short calyx rim without remains of calyx lobes; seeds 1–5.

Ridley reduced *E. Clarkeana* King to this species, I believe correctly, although Craib, Fl. Siam. Enum., I, 635, retains it provisionally. *E. corrugata* King is a little known plant described from fruiting specimens and I believe it to be merely *E. Dyeriana* with ripe fruit. The material shows considerable differences in size and ridging of the fruits, depending partly on their age, but two fruiting specimens from Cameron Highlands, both with ripe fruit (picked up from the ground but collected by an experienced native collector), show that the fruit may be almost smooth, or with only very faint, or well marked vertical ridges and corrugations. The largest fruits, which may be 6 cm. diam., and are usually depressed globular, may contain 3 or 5 seeds. Smaller fruits c. 2–2.5 cm. diam., on the same individual, apparently also ripe, may contain but one seed. Very young fruits may be either smooth or vertically ridged.

Fruit of *Forest Dept. FMS 12112* is c. 3 cm. diam., depressed globose, smooth or faintly vertically ridged, crowned by short remains of calyx tube; pericarp thick, tough, 5 mm. or more; seed 1, cotyledons very unequal, the larger with a triangular recess into which the other fits.

Fruit of *Kunstler 6822* depressed globose, cotyledons equal, point of attachment to hypocotyle close to periphery, opposing faces concave, not interlocking.

Seed of *SFN 32829* more or less hemispherical, c.  $1.5 \times 2.5$  cm., cotyledons nearly equal, inner faces nearly plane, not interlocking, cotyledons sessile, point of attachment c. 3 mm. from periphery. In a large 2-seeded fruit the testa was found to be very thick, adhering closely to the cotyledons, the inner faces of the cotyledons plane.

59. *Eugenia Hemsleyana* King, Mat. F.M.P., No. 12, 83 (1901); Ridl., F.M.P., I, 732, ?*Syzygium urceolatum* (Korth.) Merr. & Perry in Mem. Amer. Acad. Arts & Sci. XVIII, 3, 174 (1939). (Fig. 27a).

PERAK: Gopeng, 500–800 feet, *Kunstler 6114* (syntype), near Ulu Kerling, 400–600 feet, *Kunstler 8697* (syntype); Relau Tujur, *Wray 1803* (syntype); Temengoh, *Ridley 14691*.

PAHANG: Kuala Teku, *Seimund 446*; Teku, *SFN 8088* (*Haniff & Nur*); Sungai Teku, 500 feet, *SFN 31711* (*Kiah*); Sungai Tahan, *Ridley 2634*, *SFN 20086* (*Holtum*); track to Gunung Tahan, *Cornier s.n.*; Ulu Sekin, Rompin, *Forest Dept. FMS 3202*.

*Distrib.*: ? Borneo, ? Sumatra.

A tree, bark pinkish grey, slightly flaky, more or less entire; inner bark red brown, astringent. Twigs terete, more or less compressed below nodes, bark smooth, yellowish grey to pale brown. Leaves large, stiffly coriaceous, elliptic to oblong elliptic, apex shortly acuminate, base cuneate, from c. 13 cm.  $\times$  6.5 cm. to 32 cm.  $\times$  14 cm., upper surface drying almost black, somewhat polished, smooth, lower surface dull dark reddish brown; midrib narrowly impressed above, prominent and rounded below; primary nerves up to c. 25 pairs, 1–2 cm. apart, impressed above, prominent below, arising almost horizontally from midrib and curving upwards, the upper ones usually strongly curved upwards, meeting a prominent looped intramarginal nerve c. 4–7 mm. from leaf margin, with another faint series of loops close to the recurved margin; secondaries and reticulations very faint or invisible above; the secondaries below prominent, but less so than primaries, the lax reticulations fine and rather faint; petiole stout, c. 1–1.5 cm. long, channelled above.

Panicles terminal and axillary, sometimes clustered, usually peduncled, reaching c. 12 cm., with 2 or 3 distant pairs of spreading or ascending branchlets, the lower ones

up to c. 4 cm. long, the upper short, rachis and branchlets compressed, with dark striate bark; *flowers* crowded at branchlet ends in heads, sessile; *calyx* after anthesis widely campanulate, c. 6 mm. long, tapered to base and constricted into a distinct very short pseudostalk c. 1 mm. long; lobes 4, unequal, deciduous, the two outer very thick, very broad and rounded, c. 3 mm. across and 1.5 mm. tall, the inner two somewhat thinner, c. 5 mm. across and 3 mm. tall; *petals* free, suborbicular, rather thick textured, 4–5 mm. diam.; *stamens* numerous, filaments slender, flattened at base, up to 6–7 mm. long, anthers oblong or elliptic, c. 0.6 mm. long, connective gland rather conspicuous; *style* stout, c. 8 mm. long; *ovary* 2-celled, multiovulate.

*Fruit* (unripe) globular, vertically ridged or nearly smooth, apical calyx rim prominent, but without calyx lobes; pericarp probably leathery and rather thin; seed 1.

The material of *E. Hemsleyana* is not particularly good, and good flowering material and ripe fruit have yet to be collected. It differs from *E. Dyeriana* in the larger and broader more elliptic leaves with different venation—in *E. Dyeriana* the primary nerves below are black, rather broad, ascending and nearly straight, in *E. Hemsleyana* they are prominent but not broad, almost horizontal at first then curving boldly upwards, the reticulations usually more evident. The flowers of *E. Hemsleyana* are smaller and the calyx more narrowed at base into a more evident pseudostalk.

Merrill and Perry, loc. cit., state that *SFN 8088* appears to be a good match for Bornean material of *Syzygium urceolatum* (Korth.) Merr. and Perry. They state also that *S. urceolatum* closely resembles *E. Hemsleyana*. It is possible that the two are conspecific, but I have not seen material of *S. urceolatum*. If they are, King's name will stand, as Korthals' is preoccupied in *Eugenia* and there is apparently no other available.

60. *Eugenia pergamentacea* King, Mat. F.M.P., No. 12, 87 (1901); Ridl., F.M.P., I, 732. (Fig. 27b).

KEDAH: Gunong Lang near Baling, *SFN 35056* (*Kiah*), *Kiah s.n.*; Bongsu Forest Reserve, Forest Dept. *FMS 33041*.

PENANG: Government Hill, *Curtis 1440* (lectotype collection); Muka Head, *Curtis 1440*, *Ridley 10781*; Waterfall, *Curtis 1440*; Pulau Betong, *Curtis 1440*; West Hill, *Curtis s.n.*; Hindu Temple, *Hamif 1084*; sine loc., *Cantley 2689*.

PERAK: Ulu Temengoh, *Ridley 14628*.

SELANGOR: Weld Hill Forest Reserve, Forest Dept. *FMS 579*.  
*Distrib*: Endemic.

*Curtis 1440* is the type number, but this was cited by King with no other indication of locality than Penang.

Curtis frequently gave the same number to specimens from different localities which he thought belonged to the same species. In this case I have selected the Government Hill collection as the lectotype.

A small tree. Twigs terete, rather stout, bark pale brown, smooth or somewhat flaky, the very youngest shoots

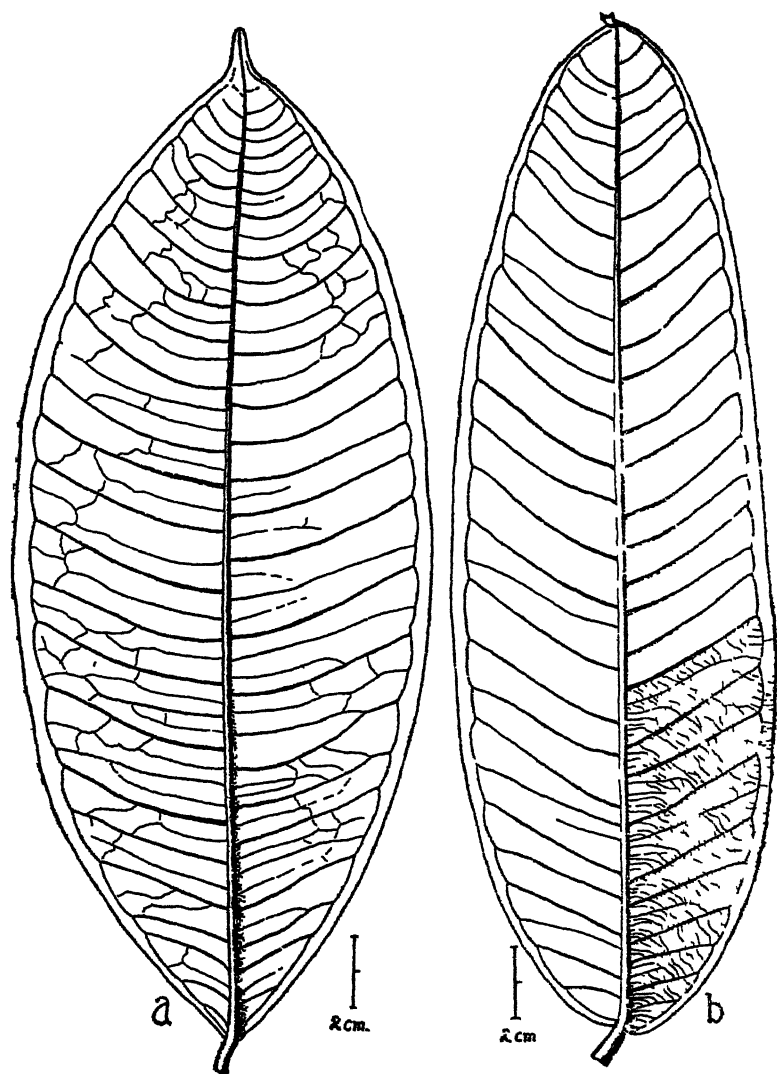


Fig. 27. a, *E. Hemsleyana*; b, *E. pergamentacea*.

with blackish brown smooth bark. *Leaves* chartaceous-coriaceous, large, narrowly elliptic oblong to oblong, up to c. 46 cm. long and 15 cm. broad, apex shortly and abruptly acuminate, base cuneate or narrowed and rounded, occasionally subcordate; upper surface drying leaden brown to blackish brown, somewhat polished, lower surface brown to dark reddish brown, dull; midrib impressed above, very prominent and rounded below; *primary nerves* c. 24-42 pairs, depressed and distinct above, very prominent below, very regular, c. 1 cm. apart, slightly ascending, running straight or curving slightly up to a prominent, nearly straight or shallowly looped intramarginal nerve 4-6 mm. from leaf margin with a much fainter loop close to margin; secondaries few, almost as prominent as primaries, reticulations transverse, close and parallel, raised and fine on both surfaces and distinct; petiole stout, up to 2 cm. long, channelled above.

*Panicles* terminal or axillary, solitary or two or three together, up to c. 15 cm. long, usually peduncled, branchlets up to c. 4 pairs, distant, spreading or ascending, the lower ones as much as 6 cm. long but usually shorter, the upper ones shorter, they and rachis rather stout or slender, more or less compressed, with dark bark; *flowers* in twos or threes at branchlet ends, buds pale green, depressed globular, c. 8-9 mm. long and 1 cm. across; *calyx* after anthesis shortly and widely campanulate, suddenly contracted into a rather stout pseudostalk c. 3 mm. long; lobes 4, subsistent, unequal, glandular, inflexed and overlapping in bud, the outer two thick, broadly oblong, c. 4 mm. across and 4 mm. tall, the inner c. 6 mm. across and 4-5 mm. tall, with thin margins; *petals* 4, ovate orbicular, with large gland dots, c. 5 mm. diam.; *stamens* very numerous, up to 6-7 mm. long, anthers oblong, c. 0.6 mm. long, connective gland large and conspicuous; *style* stouter than filaments, c. 4 mm. long; *ovary* 2-celled.

*Fruit* more or less globose, c. 2.5 cm. diam., faintly vertically ridged, calyx rim rather conspicuous, 2-3 mm. high; pericarp about 2 mm. thick; seed apparently naked, cotyledons nearly equal, inner faces plane or concave, point of attachment nearly central.

A striking species with its large oblong leaves with close parallel reticulation below, unfortunately still rather poorly represented by existing collections. It is allied to *E. Hemsleyana* but the leaves are narrower and more oblong, the primary nerves below more prominent, straighter and ascending, the reticulation closer and more evident, the flowers are much larger and the fruit is probably also larger.

61. *Eugenia Gageana* King, Mat. F.M.P., No. 12, 116 (1901); Ridl., F.M.P., I, 729. (Fig. 28a).

PERAK: Larut, *Kunstler 7563* (type collection).

*Distrib*: Endemic.

A tree up to c. 15 metres tall. *Twigs* rather stout, terete, compressed at nodes, with smooth brown bark. *Leaves* thickly coriaceous, oblong lanceolate, apex acuminate, base cuneate, c. 15 cm.  $\times$  5.5 cm., both surfaces drying dull brown, the upper smooth, punctate, the lower wrinkled, without visible glands; midrib narrowly impressed above, prominent below; *primary nerves* up to c. 20 pairs, almost invisible above, elevate, slender and distinct below, c. 0.5 cm. apart, curving up to a distinct looped intra-marginal nerve 2–3 mm. from leaf margin, secondaries and reticulations invisible above, well marked and almost as prominent as primaries below; petiole stout, less than 5 mm. long, channelled above.

*Panicles* terminal, sessile, with several spreading-ascending branches 4–5 cm. long from the base, rather stout, obtusely 4-angled, bark dark; *flowers* "waxy white tinged with red", sessile, rather crowded, in threes at ends of short branchlets; buds obovoid, 7–8 mm. long; *calyx* in bud 7–8 mm. long, narrowly obovoid, narrowed rather abruptly into a pseudostalk c. 2 mm. long; lobes 4, subequal, shallow and broad, acute or subacute, c. 2 mm. across and 1 mm. tall; *petals* calyptrate, but the outer one free, rather thick textured, orbicular, c. 3 mm. diam.; *stamens* numerous, anthers small with a rather conspicuous connective gland; *ovary* 2-celled. *Fruit* unknown.

Very little material of this species is available, and that only in bud. It is not at all like *E. densiflora* as Ridley suggests.

62. *Eugenia Prainiana* King, Mat. F.M.P., No. 12, 116 (1901); Ridl., F.M.P., I, 750. (Fig. 28b).

PERAK: Blanda Mabok, *Wray 3990* (syntype); Larut, within 100 feet, *Kunstler 5309, 6584* (syntypes).

*Distrib*: Endemic.

A large tree reaching 48 metres tall and 60–90 cm. diam. (fide *Kunstler*). *Twigs* rather stout, terete, bark smooth, brown. *Leaves* coriaceous, elliptic oblong, apex acuminate, base cuneate, up to c. 12.5 cm.  $\times$  5 cm., upper surface drying dark brown to nearly black, polished, lower surface paler, dull; midrib impressed above, elevate and keeled below; *primary nerves* about 25 pairs, very slender and slightly raised on both surfaces, indistinct, ascending slightly to a nearly straight and very fine intramarginal

nerve c. 1–2 mm. from leaf margin, secondaries and reticulations slightly raised on both surfaces, hardly distinguishable from primaries; petiole slender, up to about 1.5 cm. long.

*Panicles* terminal or occasionally from upper leaf axils, up to c. 6 cm. long, the axillary ones shorter, condensed, corymbose, on short stout peduncles, or almost sessile, branchlets short, stout, crowded, 4-angled or compressed, with dark bark; *flowers* white, sessile, in threes at branchlet ends, buds clavate, c. 9–10 mm. long; *calyx* in bud funnel shaped, 8–9 mm. long, tapering gradually to base, pseudostalk c. 4 mm. long but not well defined; lobes 5, nearly equal, persistent, broadly ovate triangular rounded, fleshy with thin cartilaginous tips, c. 2 mm. across and 1.5 mm. tall; *petals* falling as a calyptra, but the outer one free, orbicular, thin, c. 4 mm. diam., with sparse but conspicuous gland dots, the others agglutinated into a thick calyptra; *stamens* numerous, filaments subulate, anthers broadly elliptic, connective gland small but distinct; *ovary* 2-celled.

*Fruit* (probably unripe) oblong ovoid to globular, c. 2.5 cm. long and 2 cm. diam., apex with conspicuous long calyx tube 5–6 mm. long and 5 mm. diam., fringed with the remains of the calyx lobes; pericarp rather thin and leathery; seed 1, cotyledons very unequal, one about  $\frac{1}{4}$  the size of the other, inner faces more or less concave, attached to hypocotyle by short stalks.

63. *Eugenia Pearsoniana* King, Mat. F.M.P., No. 12, 116 (1901). *E. Prainiana* King var. *Pearsoniana* (King) Ridl., F.M.P., I, 751 (1922). (Fig. 28c).

PERAK: Larut, 800–1,000 feet, *Kunstler 3526* (type collection).

JOHORE: Gunong Panti, 1,500 feet in ridge forest, *SFN 32219* (Corner).

*Distrib*: Endemic.

A tree 15–30 metres tall; bark pinkish fawn, more or less entire; inner bark pale brownish drab; wood dingy brownish-yellowish. *Twigs* terete, slender, bark smooth or slightly flaky, whitish or pale brown. *Leaves* coriaceous, ovate or elliptic or oblong elliptic, apex caudate acuminate, base cuneate, or rounded and abruptly narrowed on to petiole, up to c. 10 cm.  $\times$  5 cm.; upper surface shining, drying olivaceous brown, minutely punctate or pustulate, lower surface dull, reddish brown, minutely pustulate; midrib impressed above, elevate below and rather sharply keeled; *primary nerves* up to c. 30 pairs, close together, slightly ascending and curving up to a very faint intramarginal nerve very close to leaf margin, slightly raised above and faint, slightly raised below and very fine and

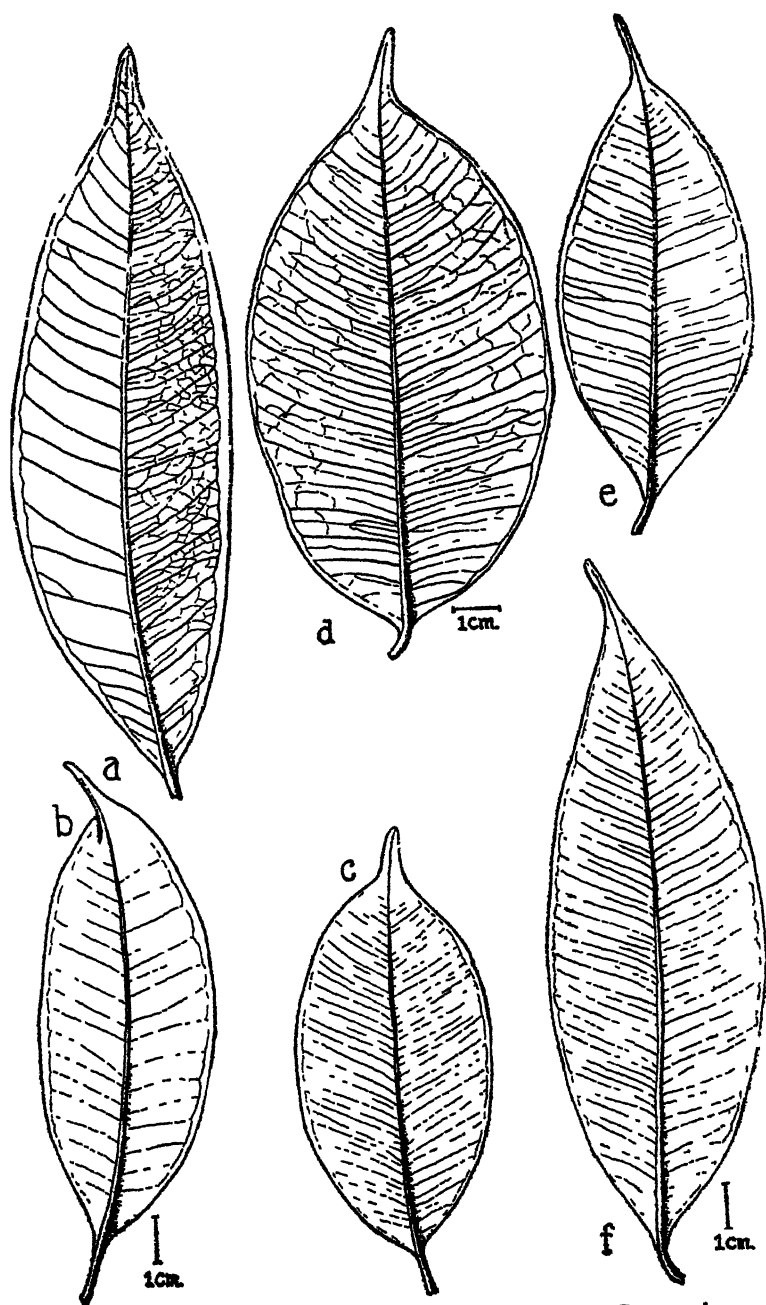


Fig. 28. a, *E. Gageana*; b, *E. Prainiana*; c, *E. Pearsoniana*; d, *E. oblata*; e, *E. lævicaulis*; f, *E. inophylla*.

inconspicuous; secondaries very faint, reticulations almost or quite invisible; petiole slender, 6–10 mm. long.

*Panicles* terminal, short, condensed, 2–4 cm. long, sessile or on very short stout peduncles, branchlets crowded, short, thick, angled and compressed; *flowers* cream white, the top of calyx tube often pinkish, sessile in twos or threes at branchlet ends, buds clavate, c. 8 mm. long; *calyx* after anthesis funnel shaped, c. 6 mm. long, tapering to a short stout not well defined pseudostalk c. 2 mm. long; mouth with 4 very shallow oblong lobes, appearing truncate; *petals* calyptrate, but the outer one free, rather thick textured, orbicular, c. 4 mm. diam., the others agglutinated; *stamens* numerous, up to c. 11 mm. long, filaments slender, subulate, somewhat flattened below, anthers broadly oblong or oblong elliptic, c. 0.6 mm. long, connective gland small; *style* slender, only a little stouter than filaments, flattened and ridged, c. 7 mm. long; *ovary* 2-celled, multiovulate. *Fruit* unknown.

Ridley reduces this species to a variety of *E. Prainiana*, but although little material of either species is known, I believe them to be distinct, although closely allied. *E. Pearsoniana* differs from *E. Prainiana* in the thinner and paler twigs, the leaves more abruptly acuminate; the stouter and more condensed inflorescence; the calyx mouth obscurely and shallowly lobed, not with definite lobes with thin tips. *Fruit* of *E. Pearsoniana* when found may add other distinguishing characters.

64. *Eugenia oblata* Roxb., Fl. Ind., II, 493 (1832); Hort. Beng. 37 (1814), nom. nud.; Duthie in Hook. fil., F.B.I., II, 492; King, Mat. F.M.P., No. 12, 114; Gagnep. in Fl. Gen. Indo-Ch., II, 805; Ridl., F.M.P., I, 749, excl. syn.; Craib, Fl. Siam. Enum., I, 652. *Syzygium oblatum* Wall. Cat. 3569; Cowan & Cowan, Trees North Bengal, 68 (1929); Merr. & Perry in Journ. Arn. Arb. XIX, 101; Mem. Amer. Acad. Arts & Sci., XVIII, 3, 187. *Eugenia limnoea* Ridl. in Journ. Roy. As. Soc. Str. Br., LXXIX, 64 (1918), excl. specimina Scortechiniana; F.M.P., I, 729, excl. syn. *E. laxiuscula* Ridl. in Journ. F.M.S. Mus., X, 133 (1920); F.M.P., I, 750. ?*E. limnoea* Ridl. var. *gracilior* Craib, Fl. Siam Enum., I, 650 (1935). (Fig. 28d).

Widely distributed but not very frequent from Setul and Kelantan to Johore, mostly on tidal rivers and near the sea.

*Distrib:* Burma, Siam, Indo-China, Borneo.

A riverside *bush* or a *tree* up to c. 15 metres tall; bark smooth or becoming slightly scaly flaky, light greyish green or brown or pale greyish buff. *Twigs* rather slender, terete, more or less compressed below nodes, bark drying brown,

smooth or flaky. *Leaves* coriaceous, broadly lanceolate to oblong elliptic, apex acuminate, base cuneate or rounded and rather abruptly narrowed to petiole, from c. 7.5 cm.  $\times$  3 cm. to 16.5 cm.  $\times$  6.5 cm.; upper surface drying olivaceous brown to blackish brown, closely and minutely punctate or sometimes pustulate, lower surface brown or reddish brown, glandular pustulate or black gland dotted; midrib impressed above, elevate below; *primary nerves* up to c. 25 pairs, usually c. 5 mm. or less apart, raised and slender on both surfaces, usually rather indistinct above and distinct below, slightly ascending and curving up to a shallowly looped or nearly straight intramarginal nerve close to leaf margin; secondaries and reticulations below numerous and close, almost as distinct as primaries; petiole up to c. 1 cm. long.

*Panicles* terminal and axillary, sometimes clustered, sessile or more usually pedunculate, shorter than leaves, more or less corymbose, reaching c. 7 cm. long, the primary branchlets few, slender, angled, ascending, the secondary branchlets short and rather crowded; *flowers* white or pale cream, calyx tube often slightly pinkish, sessile in threes or clustered at branchlet ends, buds clavate, reaching c. 1 cm. long; *calyx* funnel shaped, 6–8 mm. long, tapered to a rather slender pseudostalk 2–3.5 mm. long; lobes 5 (? or 4), subpersistent, subequal, short broad and rounded, c. 2.5 mm. wide and 1 mm. tall; *petals* calyptrate, calyptra thin, all the petals agglutinated or the outer one or two free, thin, gland dotted, orbicular, c. 5 mm. diam.; *stamens* numerous, filaments slender, subulate, up to c. 1.7 cm. long, anthers oblong elliptic 0.8–1 mm. long, connective gland small; *style* subulate, stouter than filaments, and about as long as them; *ovary* 2-celled.

*Fruit* more or less wholly suffused dull purple, depressed globose or oblong globose, slightly compressed laterally, c. 1.75 cm. long and 2 cm. broad, faintly vertically ridged, apical umbilicus rather deep, c. 4 mm., diam., calyx rim rather prominent, 1–1.5 mm. tall, bearing the somewhat enlarged but not conspicuous upright or incurved calyx lobes; pericarp c. 2 mm. thick; testa very thick, c. 0.5 mm., hard, crustaceous, adhering closely to the pale smooth surface of cotyledons; cotyledons nearly equal, opposing faces nearly plane, one cotyledon almost sessile on the hypocotyle, the other with a short broad stalk.

Syntypes of *E. laxiuscula* Ridl. and *E. limnoea* Ridl. are in Herb. Singapore. I can detect no significant points of difference between them and typical *E. oblata* Roxb. *E. oblata*, in common with most widely distributed species, shows considerable variation in size and shape of leaf and of inflorescence and there is some variation in size of flower.

Ridley includes under his *E. limnoea*, *E. oblongifolia* Duthie var. *robusta* King. This variety certainly has nothing to do with *E. oblongifolia* but neither can it be placed with *E. limnoea*. It differs in the truncate calyx mouth, the paler smoother twigs, different leaf texture and venation. I believe it to be *E. inophylla* Roxb.

In his remarks on *E. limnoea* in Journ. Roy. As. Soc. Str. Br., LXXIX, p. 64, Ridley says that King identified this as *E. densiflora* Duthie and that *E. limnoea* is allied to this species. I have seen no specimens of *E. limnoea* previously written up by King (except *Scortechini* 216, which is *E. oblongifolia* var. *robusta*), nor does King quote any of the numbers cited by Ridley. There is not, to my eye, even a superficial resemblance to *E. densiflora*.

In the original description of *E. laxiuscula* and also in Fl. Mal. Pen., Ridley cites *Curtis* 975 as the type of his species. This is an error for *Curtis* 973 (identified by King as *E. inophylla*). *Curtis* 975 is *E. Bernardi* King.

65. *Eugenia laevicaulis* Duthie in Hook. fl., F.B.I., II, 492 (1878); King, Mat. F.M.P., No. 12, 116; Ridl., F.M.P., I, 749, sub *E. oblata* Roxb. (Fig. 28e).

KEDAH: Jerai Forest Reserve, Forest Dept. FMS 17917.

PENANG: sine loc., Wallich 3600D, *Curtis* 2246, 2247; Moniot's road, 1,200 feet, *Curtis* 666; Coolie Lines, Government Hill, 1,200 feet, *Curtis* 666; Government Hill, 2,300 feet, *Curtis* 750; Muka Head, 800 feet, *Curtis* 750; top of Penang Hill, Ridley s.n.; Penang Hill, 2,300 feet, SFN 21438 (*Henderson*), SFN 21463, 21496 (*Ewart*).

MALACCA: sine loc., Maingay K.D. 753 (type collection).

JOHORE: Panti river, Kota Tinggi, Ridley 15448 (this specimen differs from the typical form in having considerably larger and broader leaves, up to 15 cm. long and 7 cm. broad, and the inflorescences longer and less condensed with more slender branches).

*Distrib.*: Endemic.

A massive but not tall tree; bark fissured. Twigs slender, terete, pale yellowish or pale brown, bark smooth and more or less polished, sometimes flaky. Leaves coriaceous, oblong lanceolate or oblong elliptic, sometimes ovate oblong, rather abruptly acuminate or caudate acuminate with a very narrow acumen, base cuneate, 6.5–10 cm. long, 2.5–4.5 cm. broad, upper surface drying olivaceous brown to almost black, more or less polished, minutely punctate or glandular pustulate, lower surface reddish brown to chocolate brown, obscurely pustulate; midrib shallowly depressed above, elevate below, more or less keeled; primary nerves about 25 pairs, close together (2–3 mm. apart), slightly raised on both surfaces and very faint, especially

above, meeting in an almost straight intramarginal nerve c. 1 mm. from leaf margin; secondaries and reticulations very faint; petiole up to c. 1 cm. long.

*Panicles* terminal or occasionally from upper axils, short and condensed, up to c. 3 cm. long, rachis stout, branchlets short and crowded, stout, 4-angled with dark wrinkled bark; *flowers* with pale green calyx and greenish white petals, usually in threes at branchlet ends, all sessile or occasionally the centre one on a very short stout pedicel; buds clavate or cylindric clavate 8-9 mm. long; *calyx* after anthesis funnel shaped or slightly campanulate, tapering evenly to base, without a well defined pseudostalk; lobes 5, triangular, subacute or blunt, c. 2 mm. across and 1.5 mm. tall, spreading or reflexed after flowering, persistent; *petals* agglutinated into a thick orbicular calyptra c. 5 mm. diam; *stamens* numerous, filaments slender, subulate, up to 9-10 mm. long, anthers oblong elliptic, 0.6-0.7 mm. long, connective gland small; *style* stouter than filaments, c. 5 mm. long; *ovary* 2-celled.

*Fruit* globose or transversely oblong globose, brown when dry, pustulate, faintly vertically ridged, c. 1.5 cm. diam., apical calyx tube prominent, c. 2 mm. tall and 5 mm. across, fringed by the spreading hardly enlarged calyx lobes; pericarp rather thin, testa rather thick, pithy crustaceous; seed 1, cotyledons nearly equal, side by side, outer surfaces finely gland pitted, inner faces somewhat concave, gland dotted, sessile on the hypocotyle or nearly so, plumule large.

Distinct from *E. oblata* Roxb., to which it is reduced by Ridley, in the pale bark of the twigs, the smaller leaves with fainter venation, shorter, much contracted inflorescences with stouter branchlets, calyx less narrowed at base, with smaller subacute triangular lobes, and shorter stamens.

66. *Eugenia Haniffii* Henderson in Gardens' Bulletin, Singapore, XI, 309, fig. 6 (1947).

PENANG: Penara Bukit, c. 1,000 feet, Curtis 794.

SELANGOR: 20th mile, Ginting Simpah, Forest Dept. FMS 12860; 23rd mile. Ginting Simpah, Forest Dept FMS 13383.

*Distrib*: Endemic.

A tree 12-15 m. tall. *Twigs* rather stout, terete, bark reddish brown nearly smooth. *Leaves* chartaceous, drying greenish brown to dull grey brown above, dull grey brown below, oblong to elliptic oblong, base cuneate, apex rather abruptly acuminate, up to c. 13 cm.  $\times$  5 cm., petiole slender, c. 5-7 mm. long; midrib sunk above, prominent below; *primary nerves* fine, not more prominent than secondaries

and hardly distinguishable from them, about 25-40 pairs, raised above and below, meeting in an inconspicuous intramarginal nerve c. 2-4 mm. from leaf margin.

*Panicles* terminal, densely flowered, often much contracted, usually less than 8 cm. long, primary branches stout with reddish brown bark, ultimate branchlets finer, more or less 4-angled, with dark striate bark; *flowers* in threes at ends of branchlets, the centre one sessile, the outer ones on pedicels c. 0.8 mm. long; *calyx* narrowly funnel-shaped in bud, c. 4-6 mm. long including lobes, gradually narrowed to a slender pseudostalk; lobes 4, conspicuous, broad, persistent after anthesis, c. 1.5 mm. tall and 2.5 mm. wide, rather thick textured with membranous margins; *petals* 4, free, membranous, persistent for some time after anthesis; *stamens* 9-12 mm. long, *style* about as long; *ovary* 2-locular with many ovules.

*Fruit* globose or slightly depressed globose, c. 1.5 cm. diam. (?unripe), crowned by calyx limb and persistent sepals; seed 1, globose, cotyledons more or less equal, attached to hypocotyle near centre of opposing faces.

This species is distinguished from *E. oblata*, to which it appears nearest, by the smaller flowers, more deeply lobed calyx, denser inflorescence, and the thinner leaves with finer and closer venation, with the intramarginal nerve further from margin.

67. *Eugenia camptophylla* Henderson in Gardens' Bulletin, Singapore, XI, 311, fig. 7 (1947).

PERAK: Gopeng, 500-800 feet, open jungle in hilly locality, *Kunstler 5594*.  
Known only from the above collection.

A tree 12-15 m. tall, stem 20-23 cm. diam., *twigs* smooth, terete, bark dull brown; *leaves* lanceolate or narrowly elliptic lanceolate, or somewhat ovate-lanceolate, up to c. 13 cm.  $\times$  4 cm., apex long acuminate, often folded or bent sideways when dry, base long narrowed and somewhat decurrent on petiole; upper surface drying blackish brown, lower surface dull reddish brown; midrib sunk above, raised below; *primary nerves* about 20 pairs, very faint above, slightly raised below, very slender and inconspicuous, meeting in a very fine intramarginal nerve 1-2 mm. from the recurved leaf margin; secondaries and reticulations a little less conspicuous than primaries below; petiole up to c. 1 cm. long, slender.

*Inflorescence* a spreading panicle, or several together, terminal or from upper one or two axils, on a peduncle up to c. 4 cm. long but usually not exceeding c. 1 cm., peduncle and inflorescence branches rather slender, strongly angled,

with striate bark, the whole inflorescence up to c. 9.5 cm. long and 6 cm. across; *flowers* densely crowded at ends of branchlets, c. 1 cm. long, sessile; *calyx* in bud funnel shaped, c. 6 mm. long and 3 mm. across mouth, tapering gradually from apex to base, the pseudostalk c. 2-3 mm. long but not sharply marked off, calyx mouth with five broad shallow inconspicuous blunt or subacute subpersistent lobes c. 1.25 mm. wide and 0.5 mm. tall, but variable in size; *p.* 's probably falling as a calyptra but easily separable, more or less orbicular, c. 3 mm. diam.; *stamens* numerous, filaments slender, up to c. 8 mm. long, anthers triangular ovate, c. 0.5 mm. long, connective gland inconspicuous; *style* considerably stouter than filaments, c. 6 mm. long. *Fruit* unknown.

A species probably allied to *E. inophylla* and to *E. oblata* but differing from the former in the larger calyx lobes, and the narrower leaves with fewer veins, and from the latter by the smaller and narrower flowers and the much narrower leaves with less prominent venation.

68. *Eugenia inophylla* (DC.) Roxb., Fl. Ind., II, 486 (1832); Duthie in Hook. fil., F.B.I., II, 480; King, Mat. F.M.P., No. 12, 114; Ridl., F.M.P., I, 750. ?*E. oblongifolia* Duthie var. *robusta* King, loc. cit., 112. *Syzygium inophyllum* DC., Prodr., III, 260 (1828); Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 188. (Fig. 28f).

In lowland forest from Penang and Kelantan to Singapore, commonest in the north of the Peninsula.

*Distrib:* Burma, Borneo, Moluccas (fide Merrill & Perry).

A tree reaching c. 24 metres tall. *Twigs* rather slender, terete or obscurely quadrangular, bark brown, smooth. *Leaves* coriaceous, narrowly elliptic or elliptic oblong or elliptic lanceolate, apex acuminate, usually rather abruptly so, base cuneate, up to c. 14 cm.  $\times$  5 cm.; upper surface drying nearly black, obscurely punctate or pustulate, somewhat polished, lower surface dark brown or reddish brown; midrib impressed above, elevate below; *primary veins* very numerous and close together, slightly elevate on both surfaces and faint, ascending and curving up to a faint intramarginal nerve c. 1 mm. from leaf margin; *reticulations* close and elongate, raised and faint on both surfaces; *petiole* up to c. 1 cm. long.

*Panicles* terminal or from upper axils, rather dense, corymbose, peduncled, up to c. 12 cm. long with numerous rather slender angled and compressed branchlets; *flowers* cream or white, crowded at branchlet ends, sessile; *buds* clavate, c. 7-8 mm. long; *calyx* funnel shaped after anthesis, c. 6 mm. long, tapering gradually to a slender pseudostalk

2-3 mm. long, mouth with five very shallow broad obscure lobes less than 1 mm. tall; *petals* calyptrate, the calyptra thin and usually the outer petal partially free; *stamens* numerous, filaments slender, subulate, up to c. 7-8 mm. long, anthers ovate triangular, 0.6-0.8 mm. long, connective gland small and acute but distinct; *style* rather slender but stouter than filaments, subulate, c. 7 mm. long; *ovary* 2-celled.

According to Roxburgh the *fruit* is large and pear-shaped. No ripe fruit on Malayan material has been seen.

This species differs from *E. oblata* Roxb. in the generally smaller flowers, with the calyx mouth almost truncate or very obscurely lobed or wavy, not with shallow broad persistent lobes; in the smoother darker twigs, not reddish and more or less flaky; in the nerves being less prominent above, rather closer, much less prominent below, reticulations on the upper surface more evident and finer, less evident below. Ridley says that the nervation of *E. inophylla* is as in *E. oblata*, but there is a distinct difference.

I include here with some doubt *Scortechini 216* which is the type of King's variety *robusta* of *E. oblongifolia* Duthie. Ridley places it under *E. oblata* Roxb., but it does not belong there (see note under that species). The two sheets of this number in Herb. Singapore have much paler twigs than other specimens of *E. inophylla*, the leaves have longer petioles and are pustulate on both surfaces. The inflorescence and flowers are those of typical *E. inophylla*.

69. *Eugenia Bernardi* King, Mat. F.M.P., No. 12, 115 (1901). *E. inophylla* Roxb., var. *Bernardi* (King) Ridl., F.M.P., I, 750 (1922). *E. simulans* King, loc. cit., 129, pro parte. (Fig. 29a).

PENANG: Government Hill, 2,000 feet, *Curtis 2845* (syntype); sine loc., *Curtis 975* (syntype).

PERAK: sine loc., *Scortechini 326* (syntype).

SELANGOR: 15th mile, Pahang track, *Ridley 8617* (syntype); Weld Hill Forest Reserve, *Forest Dept. FMS 1223, 17465*.

PAHANG: Cameron Highlands, *Forest Dept. FMS 20806*; Sungai Terolak, Ulu Telom, *Forest Dept. FMS 27553*; Kuala Sungai Kial, Telom, *SFN 23908 (Kiah)*; Rotan Tungal Forest Reserve, *Forest Dept. FMS 29353*; Sungai Tahan, *SFN 20074 (Holttum)*.

*Distrib.* ? Borneo (see Merrill & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 197).

A medium sized to tall tree. Twigs slender, terete, or the youngest ones slightly compressed, dark brown, the older ones with pale grey somewhat polished bark. Leaves thinly coriaceous, elliptic or elliptic oblong, apex abruptly

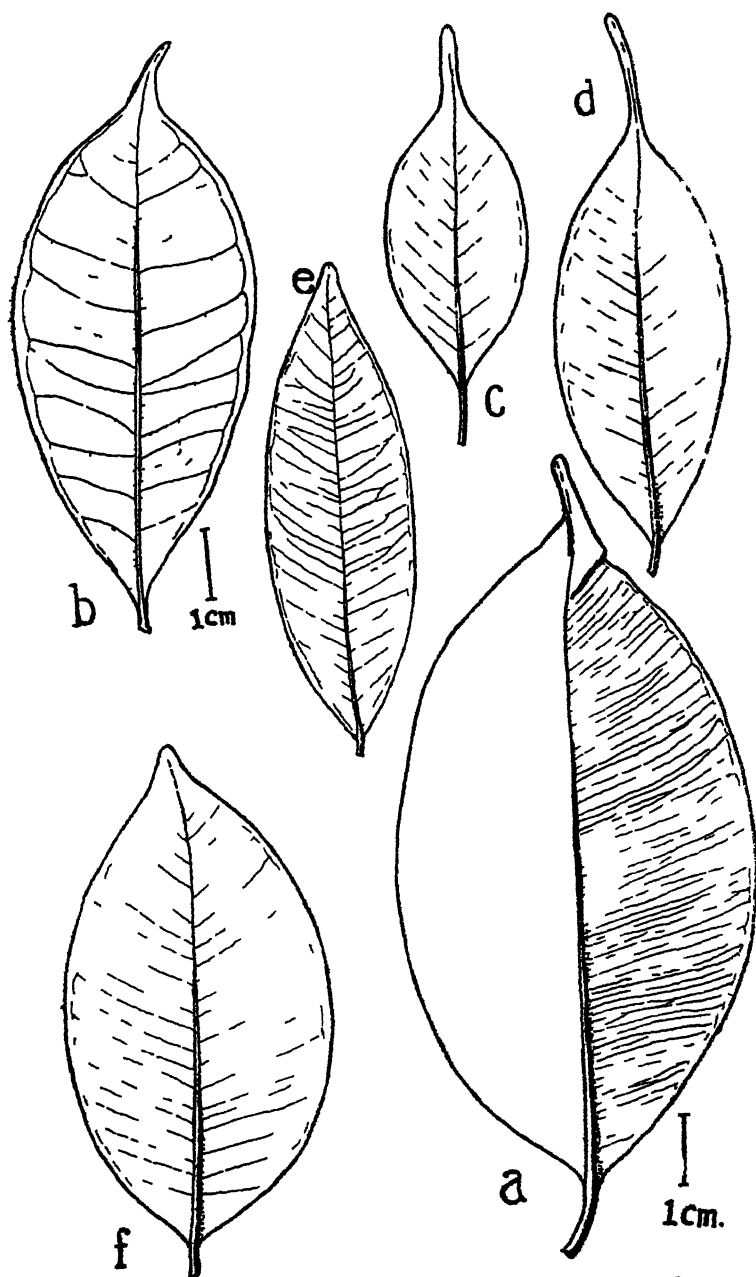


Fig. 29. a, *E. Bernardi*; b, *E. filiformis*; c, d, *E. caudata*; e, f, *E. oleina*.

and usually shortly acuminate, base cuneate and narrowed on to petiole or more or less rounded and abruptly and shortly narrowed to petiole, from c. 7 cm.  $\times$  3.5 cm. to 18 cm.  $\times$  8 cm.; upper surface when dry from greenish brown to almost black, more or less shining, closely pustulate or rugulose-pustulate, lower surface paler, greenish to dark brown, pustulate as upper surface; midrib impressed above, prominent below and pustulate; *primary nerves* numerous and close together, raised on both surfaces and very fine, ascending slightly to a fine intramarginal nerve close to the leaf margin; the close rather elongate reticulations raised on both surfaces and almost as distinct as primaries; petiole rather slender, up to c. 1.3 cm. long.

*Panicles* terminal and axillary, up to c. 10 cm. long, on peduncles of varying length, they and the rachis terete or obscurely quadrangular, with dark striate bark; lowermost branchlets when present ascending, the upper two or three pairs nearly horizontal, 4-angled; bracts and bracteoles subpersistent, small, broadly ovate rounded or ovate triangular subacute; *flowers* sessile in threes or clusters at ends of very short ultimate branchlets; buds obovoid, c. 6 mm. long; *calyx* in bud cylindric campanulate, c. 4.5 mm. long, gradually narrowed to base without a well defined pseudostalk, after anthesis widely campanulate, or funnel shaped, often rather abruptly contracted at base into a definite short pseudostalk c. 1.5 mm. long, mouth almost truncate or with 5 very short broad obscure lobes; *petals* falling in a calyptra but the outer petal free, thin, orbicular, c. 2.5 mm. diam., the others agglutinated; *stamens* numerous, filaments subulate above, more or less flattened at base, up to c. 7 mm. long, anthers oblong ovate c. 0.6 mm. long, connective gland small and inconspicuous; *style* somewhat stouter than filaments, c. 6 mm. long; *ovary* 2-celled.

*Fruit* (?unripe) globose or depressed globose, c. 2.5 cm. diam., faintly vertically ridged, apical umbilicus c. 3 mm. diam., fringed by the very short calyx rim; pericarp rather thin, testa rather thick, more or less crustaceous, seed 1, c. 1.5 cm. diam., cotyledons slightly unequal, side by side, inner faces nearly plane, gland dotted, attached at their centres to the hypocotyle by very short broad stalks.

Ridley reduces this species to a variety of *E. inophylla* Roxb., but I believe it to be sufficiently distinct in the thinner leaves, with the upper surface finely wrinkled or pustulate, the longer and more slender petioles, the shorter and more cupshaped flowers with either a very short stout pseudostalk or none.

70. *Eugenia Brantiana* Henderson in Gardens' Bulletin, Singapore, XI, 313, fig. 8 (1947).

JOHORE: Sungai Pontian Besar, common on the riverbank in the *Terminalia-Pandanus* zone, SFN 36754 (Henderson), SFN 36956 (Corner & Henderson).  
Known so far only from this locality.

A shrub or small bushy tree. Branchlets terete, bark smooth, grey brown to reddish. Leaves thinly coriaceous, oblong elliptic to ovate, up to c. 13 cm. long and 5 cm. broad, apex long acuminate, acumen 1–2 cm. long, base cuneate and narrowed on to petiole, upper surface drying greenish to reddish brown, minutely gland dotted, lower surface greenish to brownish, paler than upper, minutely gland dotted; midrib shallowly impressed above, elevate below; primary nerves up to c. 15 pairs, slender and not conspicuous above, pale and very slightly raised, slightly raised and slender below; secondaries and reticulations usually obscure above, visible below and almost as conspicuous as primaries; intramarginal nerve slender and inconspicuous, 1–2 mm. from leaf margin; petiole c. 0.5 cm. long.

Inflorescences terminal or from upper axils, paniculate, up to c. 9 cm. long, nearly sessile or on peduncles up to c. 3 cm. long, primary branchlets up to c. 2 cm. long; flowers sessile, clustered either at the ends of the primary branchlets or of shorter secondary branchlets; buds c. 1 cm. long; calyx c. 7–8 mm. c. 5 mm. across mouth, narrowed at base into a rather stout pseudostalk 2–3 mm. long, lobes broad, shallow, inconspicuous, c. 0.75 mm. tall and 2–2.5 mm. wide, pellucidly gland dotted; petals calyptrate, pellucidly gland dotted; stamens very numerous, 15–16 mm. long, anthers ovate oblong, 0.5–0.75 mm. long, connective gland conspicuous; style 12–13 mm. long; ovary 2-celled with several ovules in each cell. Fruit unknown.

Another species allied to *E. inophylla*, but differing in the paler bark of the twigs, the much longer stamens, and in being a bush or small bushy tree of tidal rivers.

71. *Eugenia filiformis* Duthie in Hook. fil., F.B.I., II, 478 (1878); King, Mat. F.M.P., No. 12, 105, pro parte; Ridl., F.M.P., I, 740; Corner, Wayside Trees of Malaya, p. 497, fig. 168. *E. clavimyrta* var. *minor* Koorders & Valeton in Meded. Lands Plantent., XL, 112 (1900). *Syzygium filiforme* Wall. Cat. 3580. (Fig. 29b).

Common in lowland forest from Perak to Singapore.

Distrib: Java.

A small or medium sized tree with dense crown and drooping branches, without buttresses; bark smooth or very finely creviced in places, warm red brown; inner layers

thin, paler brown, wood very pale buff, darkening on exposure. *Twigs* very slender, terete, bark smooth, greyish or brownish. *Leaves* coriaceous, variable in size and shape from lanceolate or ovate lanceolate to oblong elliptic, apex acuminate or caudate acuminate, base cuneate, or rounded and abruptly narrowed to and often decurrent upon petiole, from c. 5 cm.  $\times$  1.75 cm. to 11 cm.  $\times$  5 cm.; both surfaces drying more or less greenish brown, closely and minutely pustulate or black gland dotted, the glands on the lower surface often obscure; midrib impressed above, elevate below, often glandular pustulate; *primary nerves* about 8–16 pairs, c. 0.5 cm. apart, usually slightly raised and very slender and inconspicuous on both surfaces, sometimes almost invisible above, occasionally rather distinct below, curving up slightly to a fine intramarginal nerve c. 2 mm. from leaf margin; secondaries and reticulations usually obscure, especially above, often invisible; petiole slender, up to c. 7 mm. long.

*Racemes* terminal and axillary, very lax and few flowered, up to c. 10 cm. long, flowers sometimes solitary axillary or extra axillary; peduncles slender, very variable in length, rachis slender, bearing distant pairs of flowers or solitary flowers, usually with two or three clustered at its apex; pedicels filiform, very variable in length, reaching 4.5 cm. long, usually exceeding 1.3 cm.; *flowers* white, *calyx* funnel shaped, 5–6 mm. long, tapered or narrowed rather abruptly into a slender pseudostalk 0.5–8 mm. long, of the same thickness as the pedicel; lobes 4, nearly equal, sub-persistent, broad and rounded, thin, gland dotted, c. 2 mm. across and 1.5 mm. tall; *petals* 4, free or calyptrate, or the two outer free and the two inner agglutinated, thin, orbicular, 2.5–3 mm. diam., inconspicuously gland dotted; *stamens* numerous, filaments slender, subulate, up to c. 5 mm. long, anthers oblong elliptic, c. 0.4 mm. long, connective gland small and inconspicuous; *style* much stouter than filaments, c. 10 mm. long; *ovary* 2-celled.

*Fruit* globose, ovoid globose or more or less depressed globose, sometimes a little angled, up to 1.5 cm. diam., pale whitey green when ripe, apex crowned by the short calyx rim c. 3.5 mm. diam.; pericarp juicy pulpy, up to c. 5 mm. thick, testa adhering loosely to cotyledons, somewhat pithy and rather thick; cotyledons deep reddish purple, inner faces conspicuously gland dotted. Germination hypogeal, the shoot with pink winged angles. (It is rare to find in Singapore fruits that are not infected with the larvae of an insect, apparently the same as that found in *E. pseudosubtilis*).

There is a remarkable and unusual variation in the size of the flower parts in this species, even on the same twig. In *SFN 14924* the calyx tube varies from 4–6 mm. long, the pseudostalk from 2–8 mm. and the pedicel from 18–26 mm. In *Alvins 543*, the calyx tube varies from 3–6 mm., the pseudostalk from 3–7 mm. and the pedicel from 18–29 mm. The range of variation in twelve sheets is—calyx tube 2.5–6.5 mm., pseudostalk 0.5–8 mm., pedicel 13–45 mm.

The very lax racemes with few flowers and the long filiform pedicels are very distinctive.

**E. filiformis** Duthie var. *clavimyrtus* (Koord. & Valet.) var. nov. *E. clavimyrtus* Koord. & Valet. in Meded. Lands Plantent., XL, 110 (1900); Atlas Baumart. Java, III, fig. 484. *Clavimyrtus glabrata* Bl., Mus., I, 114 (1849). *Myrtus glabrata* Bl., Bijdr., 1083 (1826). *Jambosa glabrata* DC., Prodr., III, 287 (1828), non *Eugenia glabrata* DC., vel Berg.

Not uncommon in lowland and hill forest from Penang to Singapore.

*Distrib.*: Java.

*Leaves* much as in *E. filiformis* but sometimes the reticulations raised and distinct on both surfaces. *Flowers* with greenish calyx tube and white petals; *calyx* tube cylindric obconic, slightly ventricose, especially after anthesis, up to c. 20 mm. long, tapered gradually into a slender not sharply defined pseudostalk 1.5–9 mm. long, pedicel filiform 15–60 mm. long; *calyx* limb cyathiform, lobes 4, very unequal, broadly ovate rounded, subpersistent, eventually reflexed, the two outer rather thick, gland dotted, c. 4.5 mm. across and 3 mm. tall, the two inner overlapping in bud, thinner, c. 6–7 mm. across, 5 mm. tall, sparsely but conspicuously gland dotted; *petals* 4, free, or sometimes calyptrate, orbicular, conspicuously pellucidly gland dotted, c. 6–7 mm. diam.; *stamens* numerous, filaments slender, subulate, slightly broadened at base, up to c. 1.2 cm. long (to 2.5 cm. fide Koorders & Valet), anthers oblong reniform 0.6–0.7 mm. long, connective gland small and inconspicuous; *style* stouter than filaments and as long as them; *ovary* 2-celled, multiovulate.

*Fruit* oblong globose, c. 1.5 cm. long, crowned by the short calyx rim, umbilicus shallow, c. 5–6 mm. diam., seed 1, cotyledons superposed, sometimes polyembryonic.

This variety differs from the typical form in the longer and narrower calyx tube, gradually tapered into the pseudostalk and in the very unequal calyx lobes. The flowers look so different from those of typical *E. filiformis*

that it could perhaps be held to be a distinct species. However, the foliage and inflorescence of both forms are very similar and both have long filiform pedicels.

Koorders and Valeton's *E. clavimyrta* was based on *Clavimyrta glabrata* Bl., Blume's name being preoccupied in *Eugenia*. They reduce *E. filiformis* to a variety—*minor*—of their species, but the reduction of an older name to a variety of a later is not in accordance with the Rules of Nomenclature. I have examined the type of *Clavimyrta glabrata* Bl., and although the specimen is fragmentary with old and detached flowers, I believe it to be our plant.

Enumerated below are sterile or fruiting specimens which cannot be assigned definitely either to the typical form or to the variety.

KEDAH: Gunong Jerai Forest Reserve, Forest Dept. FMS 11274.

PERAK: Bikum Forest Reserve, Forest Dept. FMS 5385; Chikus Forest Reserve, Forest Dept. FMS 27245, 27246; Kota, Wray 3262.

SELANGOR: Bukit Lagong Forest Reserve, Forest Dept. FMS 14685; Kanching Forest Reserve, Forest Dept. FMS 6365.

MALACCA: Merlimau, Derry 471, *Alvins* s.n.; Bukit Bruang, Derry 451, 1230; sine loc., *Alvins* 68.

PAHANG: Beserah road, Forest Dept. FMS 3130.

Craib in Fl. Siam. Enum. I, 641 (1931) describes as new a variety *parvifolia* of *E. filiformis*. The duplicate of the type (*Kerr* 7576) in Herb. Singapore is rather poor, having only a few detached flower buds, but although the shape of the leaves suggests *E. filiformis*, the very short pseudostalk would place the specimen with *E. caudata* King rather than with *E. filiformis*.

*E. filiformis* Macfady., Fl. Jamaica, II, 116 is listed in Index Kewensis. According to data given by Pritzel the date of publication would have been 1850 or a little earlier. However, Fawcett and Rendle, Fl. Jamaica, Vol. V, in a note on p. xiv, state that the second volume of Macfadyen's Flora was never published, the printing of it having been stopped owing to the sudden death of Dr. Macfadyen. This note is merely to draw attention to the fact that Macfadyen's name has no nomenclatorial standing, although Index Kewensis lists it as if it had.

72. *Eugenia caudata* King, Mat. F.M.P., No. 12, 105 (1901), pro maxime parte; Ridl., F.M.P., I, 740. ?*E. filiformis* Duthie var. *parvifolia* Craib. Fl. Siam. Enum., I, 641 (1931). (Fig. 29c, d).

PENANG: West Hill, 2,000 feet, Curtis 744, 2,400 feet, SFN 2653 (*Burkill*), 3,000 feet, Nauen s.n.

PERAK: sine loc., *Scortechini* 392 (syntype); Maxwell's Hill, 2,500 feet, Wray 2824, 3208 (syntypes), 4,000 feet, Curtis 2007 (syntype), Ridley 2991, 5344; Larut, 1,800–2,500 feet,

*Kunstler 2421* (syntype), 2,000–2,500 feet, *Kunstler 6262* (syntype), 4,000–4,600 feet, *Kunstler 3654* (syntype); Gunong Hijau, 5,000 feet, *Scortechini 444*, (syntype), *SFN 12768* (*Burkill & Haniff*); Gunong Batu Puteh, 3,400 feet, *Wray 472, 1176* (syntypes); Ulu Batang Padang, *Wray 1514* (? syntype, ? quoted by King as 1574); Bubu Forest Reserve, *Forest Dept. FMS 29856*.

SELANGOR: Semangkok Pass, *Curtis 3758, Ridley 15591*.

PAHANG: Fraser Hill, *Forest Dept. FMS 22497, SFN 33160* (Corner).

*Distrib.*: Endemic.

A shrub or small tree up to about 12 metres tall; bark smooth entire then finely creviced, greyish brownish; inner bark pale greyish brownish drab. *Twigs* slender or very slender, terete, bark smooth, pale brownish or greyish. *Leaves* thinly coriaceous, lanceolate or ovate lanceolate or elliptic lanceolate, apex caudate acuminate, base cuneate and narrowed on to petiole, from c. 3 cm.  $\times$  1 cm. to 7 cm.  $\times$  3 cm., upper surface drying pale brown to blackish brown, slightly polished, smooth, minutely punctate, lower surface pale brown to reddish brown, dull, minutely black dotted or glandular pustulate; midrib narrowly impressed above, slightly elevate and keeled below; *primary nerves* numerous, spreading-ascending to a very obscure intramarginal nerve, almost or quite invisible on both surfaces; petiole slender, 3–6 mm. long.

*Racemes* terminal or axillary, up to c. 6 cm. long, very lax and few flowered, sometimes with 1–2 pairs of very slender spreading branches c. 2 cm. long, each bearing two terminal flowers; or almost unbranched with 5 flowers; *flowers* white, the calyces suffused red, sessile or on slender pedicels up to c. 5 mm. long; *calyx* campanulate or funnel shaped, c. 5 mm. long, contracted suddenly at base into a slender pseudostalk from 1–3 mm. long; lobes 4, equal, deciduous, broad and rounded or subacute, c. 2 mm. across and 1 mm. tall; *petals* 4, free or falling as a calyptra but not agglutinated, orbicular, obscurely gland dotted, c. 3 mm. diam.; *stamens* variable in length, reaching 12 mm., filaments slender, subulate; anthers ovate elliptic, c. 0.5 mm. long, connective gland small but distinct; *style* much stouter than filaments, and about as long as longest stamens; *ovary* 2-celled.

*Fruit* more or less globose, c. 1–1.5 cm. diam., crowned by the short calyx rim c. 6 mm. diam., seeds 1 or 2.

The small caudate acuminate leaves with almost invisible nervation and the few flowered very lax inflorescences distinguish this species.

King includes in his species and takes his specific name from *Myrtus caudata* Wall. Cat. 3631, *nomen nudum*. I have seen a sheet of this number in Herb. Calcutta, written

up by King. If it is a *Eugenia*, which I doubt, it differs from *E. caudata* in the narrower and longer leaves, not black dotted below, with a different texture and venation. The specimen is sterile and is said to have been collected in Singapore, where *E. caudata* has not been found.

See note under *E. filiformis* Duthie.

73. *Eugenia oleina* Wight, Ill., II, 15 (1841); Craib, Fl. Siam. Enum., I, 653 (1931). *E. myrtifolia* Roxb., Fl. Ind., II, 490 (1832); Duthie in Hook, fil., F.B.I., II, 483; King, Mat. F.M.P., No. 12, 118; Ridl., F.M.P., I, 750; non *E. myrtifolia* Salisb. (1796), nec Sims (1821), nec Cambess. (1829). *E. acuminatissima* Kurz. var. *parva* Merr. in Philipp. Journ. Sci., I (Suppl.) 104 (1906). *E. parva* C. B. Rob., loc. cit., IV, 391 (1909). *E. sinubanensis* Elm., Leaf. Philipp. Bot., IV, 1424 (1912). *Syzygium myrtifolium* (Roxb.) DC., Prodr., II, 261 (1828); Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 182. (Fig. 29e, f).

PENANG: Wallich, fide King.

JOHORE: Kota Tinggi, Ridley s.n.; Sungai Rhu Reba, Jason Bay, Corner s.n.; Sungai Kambau, Sedili Besar, SFN 28081 (Corner); Sungai Pendas, SFN 32254 (Corner).

SINGAPORE: Sungai Morai, Ridley s.n., 3633a; Changi, Ridley 4572; Sungai Jurong, Ridley 4985; Selitar, Ridley 5001; Jurong, Ridley 8424; Kranji, Ridley 11847; Woodlands Reserve, SFN 36959 (Ngadiman), Corner s.n.; Economic Gardens, Ridley 12195; Botanic Gardens, Ahmat s.n., Henderson s.n.; sine loc.; Wallich 3571.

Distrib: Burma, Siam, Sumatra, Anamba Islands, Borneo, Philippines.

A small tree, trunk sometimes shortly stilt rooted at base; bark light greyish brown or light orange brown, slightly flaky or very slightly papery flaky. Youngest twigs sharply 4-angled, bark smooth, dark brown, older twigs terete with brown slightly flaky bark. Leaves thickly coriaceous, lanceolate or oblong lanceolate to broadly elliptic ovate, apex acute or acuminate, base cuneate, 3.5–8 cm. long, 1–4 cm. broad; both surfaces drying pale brown to reddish brown, the lower usually paler, both minutely punctate or black dotted; midrib narrowly impressed above, slightly elevate and keeled below; primary nerves numerous, almost invisible, impressed, as are the reticulations, on both surfaces; petiole short, less than 5 mm. long.

Panicles terminal or from upper axils, often clustered at tips of twigs, peduncled, c. 4–5 cm. long, branches lax, spreading, ascending, they and rachis and peduncle slender, stiff, sharply 4-angled with pale or reddish brown smooth or somewhat pustulate bark; flowers white or the calyx green suffused purplish brown, sessile or on very short

rather stout pedicels, in twos and threes at branchlet ends; buds broadly clavate, c. 4 mm. long; *calyx* funnel shaped or somewhat campanulate, c. 3.5 mm. long, tapered to base and contracted into a pseudostalk c. 1 mm. long; lobes 4, broad and rounded, subpersistent, evident in bud, c. 1 mm. across and 0.5 mm. tall, reflexed after anthesis; *petals* falling as a calyptra, gland dotted, often not completely agglutinated and the outer one at least partially or wholly free, orbicular, c. 3.5 mm. diam.; *stamens* numerous, variable in length, up to c. 5 mm. long, filaments slender, subulate, anthers c. 0.3–0.4 mm. long, connective gland obscure; *style* much stouter than filaments, c. 6 mm. long; *ovary* 2-celled.

*Fruit* small, broadly obovoid or pyriform, c. 5 mm. long and 6–7 mm. across, dark red to reddish purple, then black when ripe; apex deeply and widely excavate, umbilicus c. 3 mm. diam., its rim with remains of 4 enlarged lobes; pericarp juicy fleshy, up to c. 2 mm. thick; seed 1, more or less boat shaped, c. 5–6 mm.  $\times$  3–4 mm., testa rather tough and leathery, adhering to cotyledons; cotyledons side by side, conspicuously gland dotted, one often half as big as the other; inner faces folded, with the large hypocotyle lying in the fold, reaching the periphery of the seed and there conspicuous. Germination epigeal.

According to Roxburgh this species was first found in Sumatra, whence it was sent to Calcutta and cultivated. Presumably Roxburgh described his *E. myrtifolia* from specimens from these cultivated plants, and I have therefore taken as typical specimens ticketed as cultivated in Hort. Bot. Calcutta. The Malayan collections agree well with those from Calcutta with a few small variations. In the more recent collections the leaves dry much paler. *Ridley 5001* has the reticulations raised on the under surface of the leaf, and *Ridley 11847* has leaves broader than the type with the reticulations dark and well marked below, but not raised.

I have seen type material of *E. parva* C. B. Rob., and *E. sinubanensis* Elm., and have no hesitation in reducing them, as Merrill and Perry do. The Philippine specimens are recorded from ridge forest up to 900 m., while in Malaya the species appears always to be a lowland one, usually near the sea behind mangrove.

When Roxburgh published his *E. myrtifolia* the specific epithet had already been used in *Eugenia*. The next oldest name appears to be supplied by *Syzygium oleinum* Wall., *nom. nud.*, which was transferred to *Eugenia* by Wight, loc. cit. This might also be considered a *nomen nudum*, for Wight gave no description or reference to a figure. But the name seems to be validated by his remarks—"These

two" (E. (S.) myrtifolia Roxb. and E. (S.) oleina R.W.) "if distinct, are so like each other that I cannot see by what characters they can be defined, I look upon them, judging from specimens only, as identical". Merrill and Perry do not admit the validation of the name by Wight, and if they are correct it never has been validated. If Merrill and Perry's synonymy is correct, which I have not been able to check, the next oldest available epithet appears to be supplied by *Syzygium campanulatum* Korth., Nederl. Kruidk. Arch., I, 203 (1847).

74. *Eugenia Benjaminia* King, Mat. F.M.P., No. 12, 106 (1901), excl. specimina sumatrana; Ridl., F.M.P., I, 734, excl. distrib. (Fig. 30a).

PERAK: Waterfall Hill, Taiping, 1,200 feet, *Wray* 2632 (syntype); Maxwell's Hill, 2,500 feet, *Wray* 2797, 3204 (syntypes); Larut, 1,500-2,000 feet, *Kunstler* 7306 (syntype).

*Distrib*: Endemic.

A shrub or small tree. Twigs slender, terete, bark smooth, pale brown. Leaves thinly coriaceous, narrowly elliptic, oblong elliptic, or oblanceolate elliptic, apex caudate acuminate, acumen up to 1.5 cm. long, base cuneate; up to c. 7.5 cm. long and 3.5 cm. broad; both surfaces drying pale brown and conspicuously and closely gland dotted; midrib impressed above, elevate below and pustulate; primary nerves numerous and close together, meeting in a nearly straight intramarginal nerve close to leaf margin, raised and fine on both surfaces, the close reticulation also raised on both surfaces and as distinct as primaries; petiole slender, wrinkled and pustulate, narrowly channelled above, c. 5 mm. long.

Racemes axillary and terminal, shorter than leaves, reaching c. 3 cm. long, few flowered but rather dense, rachis short, stout, angled, reddish or greyish scurfy; flowers pale green, filaments white, red at base, on rather stout pedicels of varying length, sometimes sessile, buds globose clavate 8-10 mm. long; calyx c. 7 mm. long, rather abruptly contracted below lobes into a stout cylindric angled tube c. 5 mm. long; lobes 4, spreading, subpersistent, ovate rounded, rather thick with thin margins, conspicuously pellucid dotted, c. 3 mm. across and 2.5 mm. tall; petals 4, free, orbicular, with conspicuous pellucid glands, c. 5 mm. diam.; stamens numerous, filaments slender, subulate, with scattered pustulate glands, reaching 10-11 mm., anthers broadly ovate oblong, c. 0.6-0.7 mm. long, without connective gland; style stouter than filaments, glandular pustulate, c. 10 mm. long; ovary 2-celled.

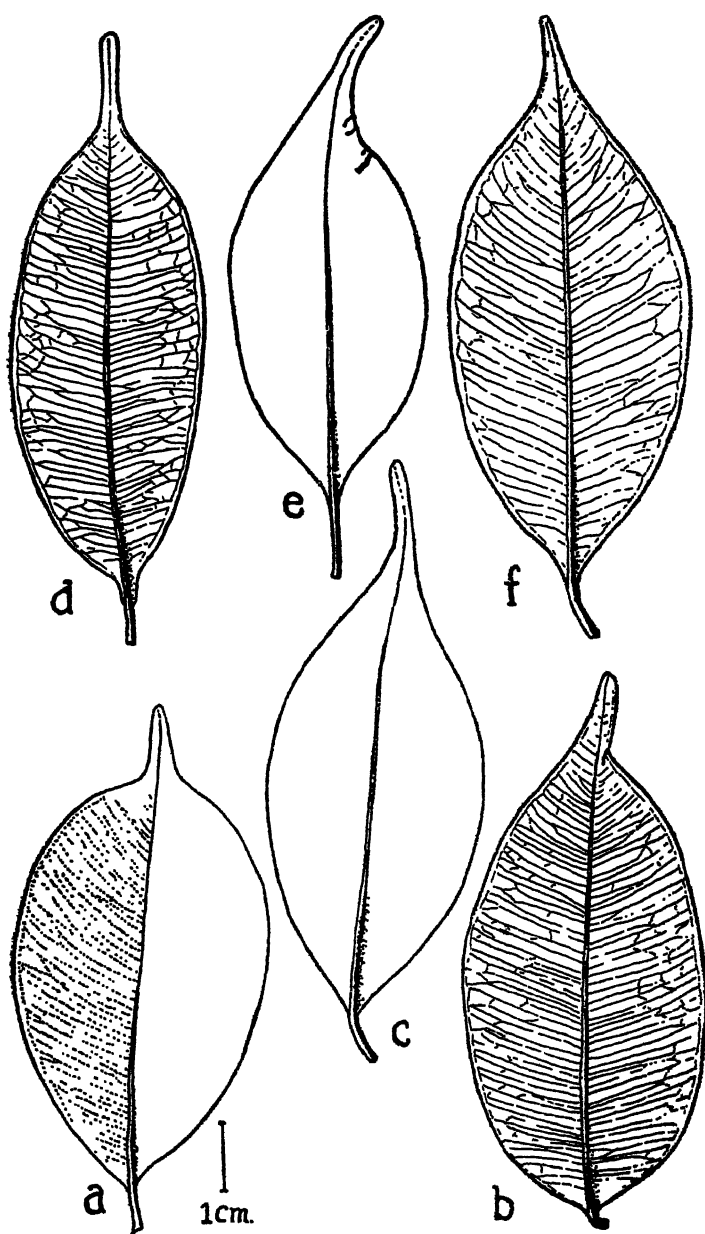


Fig. 30. a, *E. Benjamina*; b, c, *E. syzygioides*; d, *E. castanea*; e, f, *E. longiflora*.

*Fruit* "dark claret colour, waxy" (Kunstler), crowned by the deeply 4-lobed calyx limb.

The caudate acuminate glandular leaves with close raised venation on both surfaces, the very short few flowered condensed inflorescences with rather large flowers and scurfy rachis, and the conspicuous glands on sepals, petals, stamens and style distinguish this species.

King includes here *Forbes 2046* from 6,700 ft. in Sumatra, which he says "agrees absolutely in leaf with those collected in Perak", and describes the fruit of this specimen as the ripe fruit of *E. Benjamina*. He describes the fruit of *Kunstler 7706* as unripe, but judging from Kunstler's field note in which he says "fruit dark claret colour, waxy", the fruit of this specimen is nearly, if not quite ripe. In my opinion Forbes' specimen does not agree with the Perak collections, the leaves being much thicker with coarser and more distant nerves, and this, along with the much larger fruit without persistent calyx lobes, shows it to belong to some other species.

75. *Eugenia syzygioides* (Miq.) comb. nov. (Fig. 30b, c).

*Calyptranthus caryophyllifolia* Bl., Bijdr., 1089 (1825), non Willd. (1796). *Jambosa syzygioides* Miq., Fl. Ind. Bat., I, i, 431 (1855). *Syzygium syzygioides* (Miq.) Merr. & Perry in Journ. Arn. Arb., XIX, 109 (1938); Mem. Amer. Acad. Arts & Sci., XVIII, 3, 171. *Eugenia cymosa* Wight, Ill., II, 97 (1841); Duthie in Hook. fil., F.B.I., II, 482; King, Mat. F.M.P., No. 12, 100; Gagnep. in Fl. Gen. Indo-Ch., II, 823; Koord. & Valet. in Meded. Lands Plantent., XL, 126; Atlas Baumart. Java, III, fig. 493; Ridl., F.M.P., I, 737, pro parte; Craib, Fl. Siam. Enum., I, 637; Corner, Wayside Trees of Malaya, p. 496, pl. 147; non *E. cymosa* Lamarck (1789).

Common in the lowlands from Langkawi and Trengganu to Singapore, chiefly in secondary growth, and often on rocky and sandy seashores.

*Distrib.*: Burma, Assam, Siam, Andamans, Indo-China, Malaysia.

A small to large tree; bark dull reddish brown or greyish brown, fibrous, in young trees nearly smooth, becoming longitudinally fissured, shaggy and flaky. *Twigs* slender, terete, drying greyish to reddish brown, bark smooth or somewhat flaky. *Leaves* thinly coriaceous, lanceolate or oblong lanceolate to elliptic or ovate elliptic, apex acuminate or caudate acuminate, base cuneate, from c. 4-10 cm. long and 1.5-5.5 cm. broad, upper surface drying

reddish brown to nearly black, more or less polished, minutely punctate, lower surface slightly paler, dull, eglandular; midrib narrowly impressed above, elevate below; *primary nerves* numerous (to about 25 pairs) and close together, slightly ascending and running straight or curving up rather irregularly to an almost straight intramarginal nerve c. 1 mm. or less from leaf margin, raised, fine and distinct below as are the secondaries and close reticulations which are hardly if at all distinguishable from primaries, less distinct above, sometimes raised, sometimes slightly impressed, sometimes almost invisible; petiole slender, channelled above, less than 1 cm. long.

*Panicles* axillary or terminal, more usually axillary, not more than c. 6 cm. long, usually shorter, often clustered, peduncled, sometimes lax, sometimes rather dense, branches very slender, distant, spreading-ascending, compressed or 4-angled with dark bark, bracts and bracteoles minute, subpersistent, ovate acute; *flowers* white with reddish calyx, *sessile* in threes or fours at branchlet ends; *calyx* campanulate, c. 6 mm. long and 3 mm. across mouth, contracted rather abruptly into a slender pseudostalk 2-2.5 mm. long; lobes 4, subpersistent, very small, triangular, blunt, c. 1 mm. across base and less than 0.5 mm. tall; *petals* 4, free, orbicular, 2-2.5 mm. diam., sparsely pellucidly glandular; *stamens* numerous, filaments slender, subulate, up to c. 4 mm. long, anthers broadly oblong, c. 0.3-0.4 mm. long, connective gland small but distinct; *style* much stouter than filaments, subulate, c. 5 mm. long; *ovary* 2-celled, multiovulate.

*Fruit* ripening dark cherry red to purple black, globular or more or less depressed globular, 8-12 mm. diam., with conspicuous calyx rim c. 1 mm. high; pericarp 1-3 mm. thick, fleshy, seed oblong to globose, testa thick, rather leathery, or crustaceous, adhering closely to cotyledons; cotyledons side by side, nearly equal, inner faces plane or slightly concave, point of attachment to hypocotyle close to periphery; plumule and radicle small.

This common plant has been for many years interpreted as *E. cymosa* Lamk., although Gagnepain in Fl. Gen. Indoch., *loc. cit.*, indicates that the interpretation is erroneous. I have seen a photograph of the type of Lamarck's species, from which it is obvious that it is not our plant. The specimen consists of a twig with two leaves, and inflorescence and two detached flowers. The leaves are rounded or very slightly cordate at the base, broadest below the middle and with an acute acumen. The leaves of the Malayan plant are narrowed or cuneate at the base, the blade is almost always broadest about the middle, and the acumen

is blunt. The flowers of *E. cymosa* Lamk. are much larger than those of our plant and the calyx of quite a different shape.

A note by Dr. Gagnepain on Lamarck's type reads: "Ce rameau n'appartient pas à la même espèce que les fleurs. Voyez les échantillons de l' *Eugenia cymosa* dans le herbier général. Mai 1917." So that perhaps the type is a mixture. In any case no part of it has anything to do with our plant.

Merrill and Perry in Journ. Arn. Arb., *loc. cit.*, are the first to use the correct specific epithet for our plant, although their name might be liable to rejection as a tautonym. I have seen authentic material of *Jambosa syzygioides* Miq. from the Rijks Herbarium in Leiden, namely specimens bearing the names *Jambosa syzygioides* and *Calyptranthus caryophyllifolia* in Miquel's and Blume's handwriting and there can be no doubt that our plant belongs here.

76. *Eugenia castanea* Merr. in Journ. Roy. As. Soc. Str. Br., LXXVII, 212 (1917); LXXIX, 22 (1918). *Eugenia cymosa* var. *concinna* King saltem quoad *Kunstler 10521*, non *Syzygium concinnum* Wall. *Syzygium castaneum* (Merr.) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 156 (1939). (Fig. 30d).

PERAK: Ulu Bubong, *Kunstler 10521*.

JOHORE: Sungai Kayu Ara, Mawai-Jemaluang road, SFN 29249 (Corner); Sungai Berassau, Mawai-Jemaluang road, SFN 28977 (Corner).

Distrib: Borneo.

A small tree; bark dull reddish brown, nearly smooth. Youngest twigs 4-angled, brown when dry and distinctly puberulent-papillose, the older twigs terete with brown smooth or rather flaky bark. Leaves thinly coriaceous, narrowly oblong to oblong elliptic, apex caudate acuminate, the acumen c. 1 cm. long, obtuse, base cuneate, up to c. 8 cm. long and 2.5 cm. broad (in Malayan material), upper surface drying dark brown to blackish brown, more or less polished, very minutely or obscurely punctate or minutely rugulose pustulate, lower surface reddish brown, minutely glandular pustulate; midrib narrowly impressed above, elevate below; primary nerves 25-30 pairs, close together, spreading, meeting in an almost straight intramarginal nerve c. 1 mm. from leaf margin, slightly raised above and very faint, fine but distinct below as are the equally distinct secondaries and reticulations; petiole slender, up to c. 5 mm. long.

*Panicles* terminal or axillary, up to c. 75 cm. long, peduncled or branched from base, the rachis and branches slender, 4-angled and compressed, minutely puberulent-papillose; *flowers* white, sessile in threes at the ends of the short ultimate branchlets, buds narrowly clavate, c. 7 mm. long; *calyx* after anthesis funnel shaped, c. 6-7 mm. long, gradually narrowed into a slender pseudostalk c. 3-4 mm. long, the lower half minutely puberulent-papillose; lobes 5, persistent, very shallow and obscure, broad and rounded or broadly triangular subacute; *petals* falling as a calyptra but free, or slightly agglutinated, broadly ovate or orbicular, pellucidly gland dotted, c. 2-3 mm. diam.; *stamens* numerous, filaments slender, subulate, apparently glandular, up to c. 6 mm. long, anthers ovate or oblong, c. 0.3 mm. long, connective gland inconspicuous; *style* stouter than filaments, c. 7 mm. long, glandular pustulate; *ovary* 2-celled

*Fruit* (very young) globular or ovoid, c. 4 mm. diam., gland dotted, crowned by the conspicuous calyx rim c. 1.5 mm. tall and 2 mm. across, bearing the persistent calyx lobes, base contracted into a pseudostalk.

This species differs from *E. syzygioides* particularly in the scurfy inflorescence branches and young twigs and the less abrupt narrowing of the calyx into the pseudostalk. The leaves tend to be narrower and more oblong than those of *E. syzygioides*.

77. *Eugenia pseudosyzygioides* Henderson in Gardens' Bulletin, Singapore, XI, 315, fig. 9 (1947).

SOUTH TRENGGANU: Bukit Kajang, 500 feet, SFN 30421, 30451, 30497 (Corner).

PERAK: Larut, within 100 feet, Kunstler 3422.

*Distrib*: Endemic.

A tree 18-24 m. tall, c. 25-60 cm. diam. 2 m. from ground, trunk cylindric. *Bark* dull greyish, pallid, smooth, entire, faintly marked with transverse ridges but even in other places; inner bark thin, greyish brown; wood pallid buff, darkening on exposure. *Twigs* slender, terete, youngest brown or reddish brown, older ones whitey brown to pale grey, bark smooth or finely cracked. *Leaves* thinly coriaceous, ovate, ovate lanceolate to oblong lanceolate, or narrowly elliptic, apex caudate acuminate, the acumen up to c. 2 cm. long, base cuneate, from c. 4 cm.  $\times$  2 cm. to 9.5 cm.  $\times$  4.5 cm.; upper surface drying dull brown to lead colour, lower usually paler, brown to reddish brown; petiole slender, wrinkled and pustulate below, 3-5 mm. long; midrib narrowly channelled above, raised below, more or less pustulate, especially towards petiole; *primary nerves* numerous, close and parallel, not distinguishable from

secondaries, raised on both surfaces, sometimes much darker than surrounding leaf surface; intramarginal nerve very close to and partly hidden by the revolute leaf margin; upper surface minutely punctate, lower sparsely black dotted.

*Panicles* axillary and terminal, usually 4–5 cm. long but reaching c. 7 cm., peduncle and branches slender, spreading, compressed or angled, with dark, longitudinally wrinkled, often pustulate bark; *flowers* sessile in threes at ends of very short branchlets, or these branchlets so reduced that the flowers appear umbellately arranged; buds c. 5–6 mm. long; *calyx* tube funnel shaped, usually more or less pustulate, narrowing to a slender pseudostalk; lobes 5, broad, shallow, rounded, c. 0.5 mm. wide and 0.3 mm. tall; *petals* calyptrate or occasionally free, orbicular; *stamens* up to c. 5–6 mm. long, anthers oblong, c. 0.4 mm. long with conspicuous brown connective gland; *style* rather stout, 5–6 mm. long; *ovary* 2-celled. *Fruit* unknown.

This species is evidently closely allied to *E. syzygioides*, but differs in the longer pseudostalk and the funnel shaped pustulate calyx tube. Sterile material can hardly be distinguished from *E. syzygioides* in the herbarium except perhaps by the usually narrower and more oblong leaves, but in the field the two species are distinct, *E. pseudosyzygioides* having a smooth pale bark, and *E. syzygioides* a more or less fissured and flaky dark red or fuscous brown bark.

78. *Eugenia praestigiosa* Henderson in Gardens' Bulletin, Singapore, XI, 318, fig. 10 (1947).

PERAK: without locality, *Scortechini s.n.*

Known only from this collection, consisting of 5 sheets in Herb. Calcutta.

?A tree, *twigs* terete, with smooth bark, dark brown or dark reddish brown, in places pale grey and finely cracked. *Leaves* coriaceous, oblong lanceolate or oblong elliptic, up to c. 9 cm.  $\times$  3.75 cm., apex acuminate, base narrowed, upper surface drying olivaceous brown or reddish brown, slightly shining, minutely and densely punctate, lower surface paler and duller, minutely and densely black pustulate-dotted; midrib sunk above, raised below and pustulate except at apex, longitudinally wrinkled; *primary nerves* c. 12–15 pairs, very fine and slender above, slightly raised, fine below, but rather more conspicuous than on upper surface, raised, meeting in a fine intramarginal nerve c. 1 mm. from the recurved leaf margin; secondaries and reticulations fine and raised below but distinctly less conspicuous than primaries; petiole c. 1 cm. long, rather slender, deeply channelled above.

*Inflorescences* crowded, terminal or in upper axils, spiciform or paniculate with few branches, up to c. 45 cm. long, rachis compressed or angled with strongly striate pale brown bark. *Flowers* sessile, crowded at or near ends of inflorescence branches; *calyx* in bud c. 6–6.5 mm. long and 3.5–4 mm. across mouth, obconic or campanulate and tapering gradually to base, pseudostalk very short, not evident, the mouth rather abruptly expanded into 4 deep rounded persistent lobes c. 2 mm. high and 3 mm. across; *petals* 4, free, reflexed after anthesis, more or less orbicular, c. 5 mm. across, gland dotted; *stamens* numerous, filaments slender, up to c. 9–10 mm. long, anthers oblong, c. 0.7–0.8 mm. long, connective gland obscure or absent; *style* rather stout, tapering to apex, c. 8 mm. long; *ovary* 2-celled with several or many ovules in each cell. *Fruit* unknown.

Distinctive amongst Malayan species in the short crowded inflorescences and the crowded flowers with conspicuous calyx lobes and petals. The inflorescences recall those of *E. rugosa* but the flowers and foliage are quite different. The flowers resemble those of *E. longiflora* but are shorter, with more conspicuous petals.

79. *Eugenia longiflora* (Presl) F. Vill., Nov. App. Fl. Filip., 86 (1880); Gagnep. in Fl. Gen. Indo-Ch., II, 822; Craib, Fl. Siam. Enum., I, 650; Corner, Wayside Trees of Malaya, p. 499, pl. 151, fig. 168. *Syzygium longiflorum* Presl, Bot. Bemerk., 70 (1844). *Myrtus lineata* Bl., Bijdr., 1087 (1826), non Sw. (1800). *Jambosa lineata* DC., Prodr., III, 287 (1828). *Syzygium lineatum* (DC.) Merr. & Perry in Journ. Arn. Arb., XIX, 109 (1938). *Eugenia lineata* Duthie in Hook. fil., F.B.I., II, 487 (1878); King, Mat. F.M.P., No. 12, 99; Ridl., F.M.P., I, 738; Koord. & Valet., Atlas Baumart. Java, III, fig. 485; non DC. (1828). *Jambosa rubricaulis* Miq., Fl. Ind. Bat., I, i, 429 (1855). *Eugenia rubricaulis* (Miq.) Duthie in Hook. fil., F.B.I., II, 487. *Jambosa Teysmanni* Miq., loc. cit., 429. *Eugenia Teysmanni* Koord. & Valet. in Meded. Lands Plantent., XL, 164 (1900). *E. marivelesensis* Merr. in Philipp. Journ. Sci., I, Suppl., 106 (1906). *E. Miquelii* Elmer, Leaf. Philipp. Bot., IV, 1441 (1912). *E. simulans* King, Mat. F.M.P., No. 12, 128 (1901), pro parte. *E. longicalyx* Ridl. in Journ. Bot., LXVIII, 11 (1930), fide Merrill & Perry. (Fig. 30 e, f).

Very common in the lowlands from Kedah to Singapore, in secondary growth, by rivers, and in forest.

*Distrib:* Burma, Indo-China, Siam, Malaysia, Philippines.

A small or medium sized tree, old trees sometimes large—up to c. 22 m. tall—and spreading, occasionally stilt

rooted; bark smooth and entire or closely and faintly transversely rugose with persistent leaf scars, eventually shallowly flaky-cracked in small thin superficial pieces, not papery flaky, pinkish- or rufous-fawn; inner bark fawn or fawn drab. *Twigs* slender, terete, bark smooth, drying pale brown or reddish brown. *Leaves* thinly coriaceous, elliptic lanceolate or ovate lanceolate to narrowly elliptic or oblong elliptic, apex rather abruptly acuminate or caudate acuminate, base cuneate, from c. 5–11 cm. long and 2–5 cm. broad; upper surface shining, drying olivaceous brown to dark brown, usually minutely and closely punctate, lower surface pale brown to reddish brown, usually with scattered black gland dots; midrib impressed above, elevate below; *primary nerves* numerous and close together, indistinct above and slightly impressed, raised below and very fine, more distinct than on upper surface, intramarginal nerve shallowly looped, c. 1 mm. from leaf margin, secondaries and close reticulations below almost or quite as distinct as primaries; petiole slender 0.5–1 cm. long.

*Panicles* terminal or from upper axils, shortly pedunculate or branched from base, or clustered, rather dense, up to c. 10 cm. long and wide, rachis and branches slender, 4-angled, the youngest branchlets compressed, bark dark brown and smooth when dry; *flowers* white or pale green or pale pink, fragrant, in threes or twos or sometimes solitary at branchlet ends, sessile or shortly pedicellate, the minute broad bracts and bracteoles subpersistent, buds globose clavate, c. 7 mm. long; *calyx* cylindric funnel shaped, somewhat constricted below lobes and tapering gradually to base, c. 6 mm. long, striate and somewhat 4-angled; lobes 4, nearly equal, broadly oblong, rounded or truncate, conspicuous, persistent, sometimes conspicuously gland dotted, c. 2–3 mm. across and 2 mm. tall; *petals* 4, free, thin, orbicular, sparsely pellucidly gland dotted, c. 3–4 mm. diam.; *stamens* numerous, filaments slender, subulate, up to c. 1.3 cm. long, anthers oblong ovate, c. 0.6 mm. long, without connective gland; *style* much stouter than filaments, c. 10 mm. long; *ovary* 2-celled.

Ripe *fruit* oblong ovoid, up to c. 1.3 cm. long and 1 cm. across, opaque white, crowned by the 4 persistent incurved calyx lobes c. 1.5 mm. high, surrounding a deep narrow excavation c. 3 mm. diam.; style not persistent but leaving a brown scar at base of excavation; pericarp pure white, pithy-pulpy, sweetish and faintly aromatic, c. 2–3 mm. thick; seed oblong ovoid, c. 1 cm. long and 0.6 cm. across, testa brown, rather thick, crustaceous, adhering closely to the cotyledons; cotyledons superposed, nearly equal or rather unequal, outer surfaces smooth, pale green, very minutely

gland dotted; inner faces plane or nearly so, attachment to hypocotyle near the centre or the periphery by very short broad stalks, radicle and plumule small, often faintly tinged purplish pink. Germination hypogeal, young shoot deep pink, strongly 4-angled.

I have examined a fragment of the type of *Syzygium longiflorum* from Presl's herbarium (collected by Cuming in the Philippines) and have no doubt our plant is the same. Indeed the Malayan material matches it more closely than the bulk of the Philippine material identified with it, the latter having as a rule larger flowers.

*E. longiflora* and *E. tumida* have been somewhat confused in Herb. Singapore and Herb. Calcutta and possibly elsewhere, due to the close similarity in foliage. Sterile material or material in young bud is not determinable with certainty, but in flowering or fruiting specimens the differences are obvious and may be tabulated conveniently as follows:

*E. longiflora*

1. Calyx lobes deep, oblong, persistent.
2. Calyx tube not swollen above base, more or less 4-angled after anthesis.
3. Fruit oblong or ovoid, not more than about 1.3 cm. long, crowned by the 4 enlarged calyx lobes, pure white when fully ripe.

*E. tumida*

1. Calyx lobes broad, shallow, dropping soon after stamens.
2. Calyx tube usually slightly swollen just above base, not 4-angled.
3. Fruit globose or depressed globose, c. 2 cm. diam., crowned with narrow tubular calyx rim, dark brownish green when fully ripe.

80. *Eugenia tumida* Duthie in Hook. fl., F.B.I., II, 487 (1878); Craib, Fl. Siam. Enum., I, 665; Corner, Wayside Trees of Malaya, p. 504, fig. 168. *E. pyrifolia* (Bl.) Duthie, loc. cit., 487 (1878); King, Mat. F.M.P., No. 12, 99; Ridl., F.M.P., I, 738; non Desv. (1825). *Calyptanthus pyrifolia* Bl., Bijdr., 1090 (1826). *Syzygium pyrifolium* (Bl.) DC., Prodr., III, 261 (1828); Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 182. (Fig. 31a).

Common in the lowlands from Kedah to Singapore, in secondary growth and forest. There are two collections only from Penang, Cantley's collector 3128 and Phillips s.n. The species has not been recorded again from Penang and these collections may be wrongly localised.

*Distrib*: Siam, Borneo.

A small tree, bark pinkish grey, nearly smooth, very like that of *E. longiflora*. Youngest twigs 4-angled, older ones terete, smooth, drying pale brown to whitish brown. Leaves coriaceous, elliptic lanceolate or ovate lanceolate to narrowly elliptic or elliptic oblong, apex rather abruptly acuminate, base cuneate or narrowed rather abruptly on to petiole, c. 4 cm.  $\times$  1.5 cm. to 11 cm.  $\times$  6 cm.; upper surface shining, drying brown to blackish brown, sometimes very minutely punctate, lower surface dull, paler, usually minutely gland dotted; midrib impressed above, elevate below; primary nerves numerous and close together, indistinct above and slightly impressed, raised below and very fine, usually distinct, intramarginal nerve irregularly looped, close to leaf margin; secondaries and reticulations indistinct or invisible above, very fine below, slightly less distinct than primaries; petiole slender, c. 1 cm. long.

Panicles axillary and terminal, up to c. 10–11 cm. long and about as wide, sometimes longer, many flowered, pyramidal or corymbose, usually long peduncled, rather laxly branched, the rachis, branches and branchlets slender, acutely 4-angled or sometimes narrowly winged, bark brown, smooth or slightly pustulate, bracts and bracteoles minute, triangular acute, subpersistent; flowers fragrant, calyx yellowish, stamens white, sessile, in twos, threes or clusters at ends of the short ultimate branchlets, buds clavate, c. 6–6.5 mm. long; calyx, after anthesis, more or less funnel shaped or narrowly campanulate, c. 5.5–6 mm. long, the tube vertically striate, very gently tapered to about half, then slightly constricted, and tapered into a stout, not well defined pseudostalk, c. 3 mm. long, slightly swollen about the ovary; lobes 4, deciduous, broad shallow and rounded, less than 0.5 mm. tall; petals 4, free or falling as a calyptra with the two outer petals free and the inner more or less agglutinated, orbicular, conspicuously pellucidly gland dotted, c. 2.5 mm. diam.; stamens numerous, filaments slender, subulate, outer ones reaching c. 7–8 mm., usually somewhat shorter, anthers oblong, c. 0.6 mm. long, connective gland small and inconspicuous; style subulate, much stouter than filaments, c. 7 mm. long; ovary 2-celled.

Fruit pale green, finally greenish brown to dull brown, often slightly vertically ridged, depressed globose, c. 2.5 cm. across and 2 cm. high, the apical calyx tube remains consisting of a narrow small tube c. 3 mm. diam. and 1 mm. high; pericarp pithy, slightly juicy, sweet, 2–4 mm. thick, seed lying more or less loosely within; testa white, turning brown, thick, pithy, crustaceous, adhering closely to cotyledons; cotyledons side by side, surfaces slightly wrinkled, shining, pale green or almost white, minutely

gland dotted; inner faces nearly plane, only slightly ridged, attachment nearly central, sessile or with exceedingly short broad stalks, plumule rather large, radicle small. Germination hypogeal.

Two collections from Johore—Bukit Tinjau Laut, *SFN 37086* (*Ngadiman*) and Mawai, *SFN 34707* (*Ngadiman*) differ from *E. tumida* in the rather thicker leaves with spaced primary nerves, bark of trunk and twigs paler, inflorescence branches stouter, compressed and not sharply angled, and the stamens a little longer. The shape of the calyx is that of *E. tumida*.

81. *Eugenia linocierioidea* King, Mat. F.M.P., No. 12, 118 (1901); Ridl., F.M.P., I, 749. (Fig. 31b).

PERAK: Relau Tujor, 200 feet, *Wray 1898, 2595* (syntypes); Gopeng, within 100 feet, *Kunstler 4580* (syntype); Batang Padang, 300–500 feet, *Kunstler 7980, 8094* (syntypes).

SELANGOR: Rantau Panjang, Forest Dept. FMS 12776; Ginting Simpah, Forest Dept. FMS 29803.

SINGAPORE: Bukit Timah, *SFN 34775* (*Henderson*), *SFN 34982* (*Corner*), *SFN 36116* (*Kiah*).

Distrib: Endemic.

A tree up to c. 18 m. tall, bark pinkish brown, smooth or finely tessellately wrinkled or creviced or irregularly pimply; inner bark very thick, c. 2 cm., dark blood red with sticky sap. Young twigs obtusely or acutely 4-angled, older twigs terete, bark brown, nearly smooth. Leaves coriaceous, lanceolate or oblong lanceolate or elliptic lanceolate, or elliptic to ovate elliptic, apex acuminate or caudate acuminate, base cuneate, from c. 3.5 cm. to 8 cm. long and 1.5 cm. to 4 cm. broad; upper surface shining, drying from brownish green to blackish brown, minutely punctate, lower surface paler and duller, black dotted; midrib impressed above, elevate below; primary nerves numerous and close together, ascending slightly and running straight to an intramarginal nerve very close to the leaf margin, very fine and raised on both surfaces, or almost invisible above, reticulations close, usually very slightly less distinct than primaries; petioles very slender, from c. 3–10 mm. long.

Panicles terminal or from upper axils, up to c. 6 cm. long and 8 cm. across, much branched and densely flowered, the branches spreading-ascending, obtusely 4-angled with smooth reddish brown bark, the ultimate branchlets acutely angled or almost winged; flowers white, sessile or shortly pedicelled, in threes or clusters at branchlet ends, buds globose clavate c. 7 mm. long; calyx c. 5 mm. long, funnel

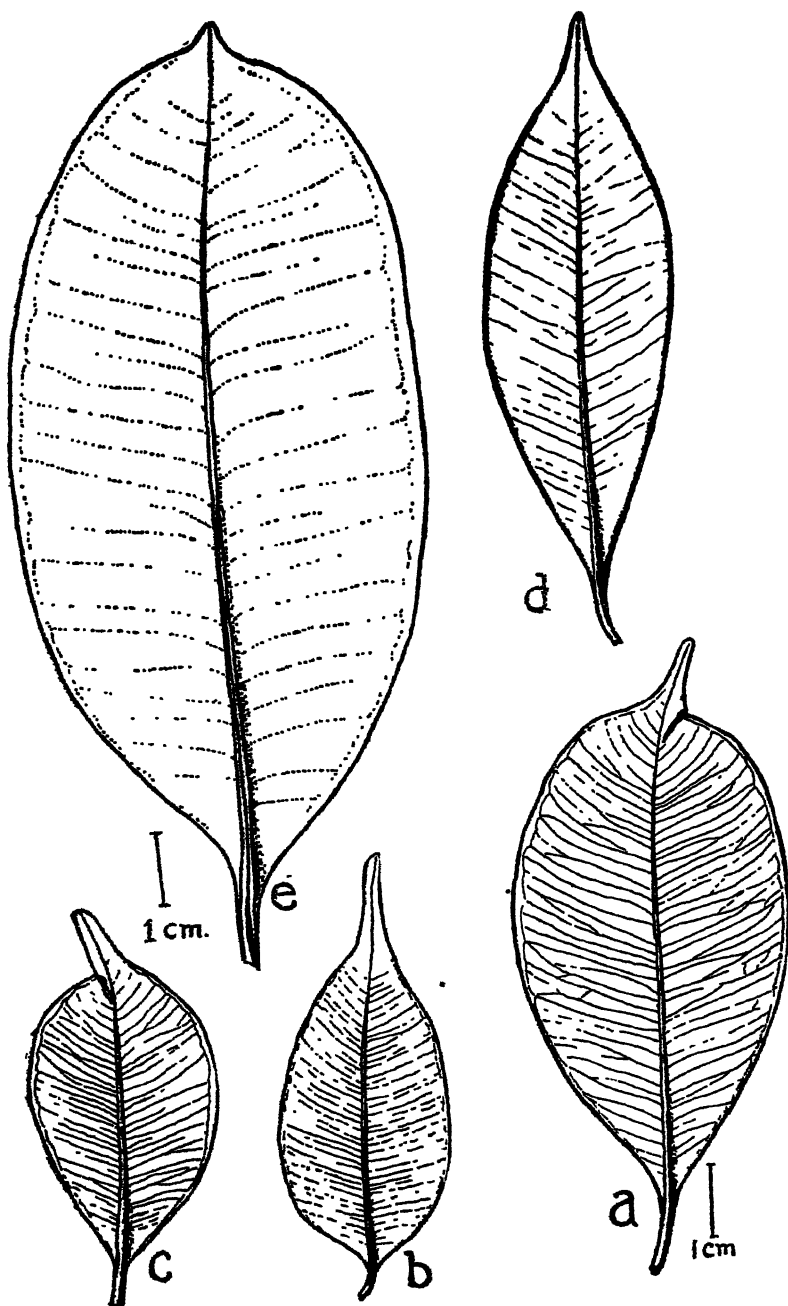


Fig. 31. a, *E. tumida*; b, *E. linocierioidea*; c, *E. goniocalyx*; d, *E. cyrtophylloides*; e, *E. cerina*.

shaped, contracted below lobes into a stout, tapering, angled and ridged tube; lobes 4, persistent, broadly ovate rounded, c. 2 mm. across and 1.5 mm. tall; *petals* 4, free, orbicular, 3–3.5 mm. diam.; *stamens* numerous, up to 7–8 mm. long, filaments slender, subulate, anthers broadly elliptic oblong, c. 0.4 mm. long, without connective gland; *style* stouter than filaments, c. 7 mm. long; *ovary* 2-celled.

*Fruit* oblong globose, vertically ridged or corrugate or almost smooth, c. 1 cm. long, apex with the 4 reddish, swollen, incurved calyx lobes; seed 1, cotyledons sessile, attached to hypocotyle near their centres, inner faces almost plane; germination hypogeal.

This species resembles *E. longiflora* but differs from it in the very thick bark, the stouter inflorescence branches, the more angled calyx tube and the different fruit.

The specimens from Bukit Timah, Singapore differ from the rest in their rather broader leaves and shorter panicles.

82. *Eugenia goniocalyx* Ridl., F.M.P., V (Suppl.), 309 (1925). (Fig. 31c).

PAHANG: Fraser Hill, 4,000 feet, SFN 11456 (Nur), type collection; Perak-Pahang boundary, Cameron Highlands, Forest Dept. FMS 28109; Sungai Yatang, Cameron Highlands, Forest Dept. FMS 34016; Brinchang, Cameron Highlands, 5,000 feet, SFN 31288 (Holtum).

*Distrib*: Endemic.

A tree c. 12 metres or more tall. Youngest *twigs* slender, 4-angled, older ones terete, drying brown and nearly smooth. *Leaves* coriaceous, elliptic or broadly oblong elliptic, apex rather abruptly cuspidate, the cusp blunt, base cuneate, up to c. 5.5 cm. long and 3.5 cm. broad, upper surface shining, drying olivaceous or dark brown, sometimes very minutely punctate, lower surface dull, paler, sometimes glandular pustulate; midrib deeply and narrowly impressed above, elevate below; *primary nerves* numerous and close together, meeting in a looped intramarginal nerve c. 1 cm. from the recurved leaf margin, raised on both surfaces, fine but distinct, especially below; secondaries and reticulations almost as distinct as primaries; petiole slender, up to 6–7 mm. long.

*Panicles* terminal or from uppermost leaf axils, up to c. 5 cm. long, densely flowered, the branches short and rather stout, 4-angled; *flowers* white, usually in threes at branchlet ends, sessile or shortly pedicelled, buds clavate, 8–9 mm. long; *calyx* after anthesis funnel shaped, c. 7–8 mm. long,

narrowed gradually to base from below lobes, striate and sharply 4-angled; lobes 4, persistent, spreading, broad and rounded, c. 3 mm. across and 2 mm. tall; *petals* 4, free, orbicular, concave, c. 5 mm. diam.; *stamens* numerous, filaments slender, subulate, reaching c. 1.8 cm. long, anthers elliptic or elliptic oblong, c. 0.7–0.8 mm. long, without connective gland; *style* stouter than filaments and as long as the longest of them; *ovary* 2-celled.

*Fruit* in life green with 4 sharp vertical ridges and smaller blunt irregular ridges between them, globose when dry, c. 1–1.25 cm. diam., blackish brown to reddish brown, smooth except for about 4 sharply raised vertical lines from apex to base, apex crowned by the persistent calyx lobes; boiled up fruits c. 1.5 cm. diam., with rather obscure vertical ridges, surface wrinkled between them; pericarp very thin and leathery, testa thick, crustaceous, adhering to cotyledons; seed 1, cotyledons minutely gland dotted, side by side, one about one-third larger than the other, inner faces nearly plane, attached to the hypocotyle near the periphery by short broad stalks.

Allied to *E. linocierioidea* as Ridley points out, but differing in the broader leaves with rather more distinct venation, the larger flowers with much longer stamens, and in the different fruit.

83. ***Eugenia quadribacteata*** Henderson in Gardens' Bulletin, Singapore, XI, 320, fig. 11 (1947). (Fig. 34a).

PENANG: Waterfall, Curtis s.n., undated.

JOHORE: Kota Tinggi-Mawai road, frequent in drier parts of swampy forest, SFN 30986 (Corner).

PERAK: Upper Perak, 1,000 feet, Wray 3771, two sheets in Herb. Calcutta which may represent fruiting material of this species.

A tree c. 20 m. tall; *twigs* stout, terete, bark smooth or creviced or slightly flaky, brown or greyish brown. *Leaves* generally oblong elliptic, occasionally tending to be ovate, up to c. 25 cm. long and 10 cm. broad, but generally rather smaller, apex shortly bluntly acuminate or acute, base shortly narrowed and decurrent on petiole; petiole stout, c. 1–1.3 cm. long; *primary nerves* very numerous and close together, hardly distinguishable from secondaries, up to about 60 pairs, fine but distinctly elevate on both surfaces; intramarginal nerve as distinct as primaries, c. 2–3 mm. from the revolute leaf margin; both surfaces densely and minutely punctate.

*Inflorescences* terminal or occasionally axillary, sometimes fasciculate, axis and branches as stout as or stouter than twigs, rounded or compressed or angled, up to c. 9 cm.

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long, branches distant and short, usually horizontal or somewhat decurved; *flowers* sessile, densely crowded in heads at the branch ends, each flower subtended by 4 broad, triangular, more or less persistent, blunt bracteoles; *calyx* more or less globose in bud, obconic after anthesis, c. 3–4 mm. long and 4–5 mm. across mouth, lobes 5, broadly and shallowly triangular, rounded or somewhat acute; *petals* calyptrate; *stamens* c. 5–6 mm. long, *style* about the same length. Immature *fruit* globular or somewhat depressed globular, 5–6 mm. diam., crowned by the calyx rim.

This species is a distinct one in its large closely veined leaves and the stout inflorescence with the conspicuously bracteolate flowers in heads.

84. *Eugenia cyrtophylloides* Ridl. in Journ. Roy. As. Soc. Str. Br., LXXIX, 65 (1918); F.M.P., I, 749. (Fig. 31d).

PAHANG: Wray's Camp, Tahan, Ridley 16274, type collection. Known only from this collection. Perhaps allied to *E. cerina*, but not greatly resembling it.

A tree with pale reddish bark (fide Ridley). *Twigs* terete with pale bark. *Leaves* lanceolate, acuminate, base long narrowed, decurrent on petiole, up to c. 8 cm. long and 2.5 cm. broad, petiole 3–5 mm. long; midrib channelled above, boldly raised below and more or less keeled; *primary nerves* c. 30 pairs, raised above and very slender, slightly raised below and very inconspicuous, meeting in a faint intramarginal nerve usually hidden by the revolute leaf margin; secondaries and reticulations hardly less distinct than primaries; upper surface usually more or less polished, drying greenish, lower surface dull, greenish brown with black gland dots.

*Panicles* terminal, up to c. 7 cm. long and 4 cm. wide, usually with a pair of branches c. 3–4 cm. long from near the base and two or three shorter pairs higher up the rachis, the branches not very stout, ascending, compressed or 4-angled, with striate bark; *flowers* in groups of threes at the ends of the short ultimate branchlets, sessile or very shortly pedicelled, *calyx* tube c. 3–4 mm. long, gradually narrowed to a very short stout pseudostalk, the tube funnel shaped in the open flower; lobes 4, triangular ovate, quite distinct; *petals* 4, falling as a calyptra but separable, rather thick, gland dotted, unequal, the two larger broadly ovate rounded, c. 1.5 mm. across, the two smaller ones narrower. *Stamens* rather numerous (more than 20), c. 1.5 mm. long, filaments broad, anthers oblong, connective gland visible; *style* short. *Fruit* unknown.

85. *Eugenia cerina* Henderson in Gardens' Bulletin, Singapore, XI, 322, fig. 12 (1947). *E. punctulata* King, Mat. F.M.P., No. 12, 122 (1901); Ridl., F.M.P., I, 747; Corner, Wayside Trees of Malaya, p. 502; non F.M. Bailey (1896). *Syzygium incarnatum* Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 195 (1939), non *Eugenia incarnata* Elm. (Fig. 31e).

Common in the lowlands from Penang to Singapore, often in swampy forest and near rivers.

*Distrib*: Sumatra, Borneo.

A tree up to c. 27 m. tall, fluted at base, or buttressed, the buttresses sometimes up to c. 1.5 m., or cylindric, or with a few stilt roots; bark reddish or reddish orange, rugose in older trees, more or less papery flaky, a thin green layer below surface, then a buff or yellowish fibrous brittle inner layer; wood hard, pale buff. *Twigs* terete or the youngest somewhat compressed, bark brownish, thinly papery flaky. *Leaves* coriaceous, obovate, oblanceolate or occasionally oblong, apex rounded, retuse, or with a short blunt point, or abruptly acuminate with acute or blunt acumen, narrowed at base gradually or abruptly, 2.5–11 cm.  $\times$  1.5–5 cm.; both surfaces drying olivaceous or pale brown to dark brown or reddish brown, the lower usually paler; midrib depressed above, elevate and keeled below; *primary nerves* usually about 16 pairs but often more, not conspicuous above, more or less raised below, faint and not easily distinguishable from secondaries, meeting in a slender intramarginal nerve close to the recurved leaf margin; secondaries and reticulations obscure or faint above, sometimes invisible below; sometimes almost as conspicuous as primaries; petiole 0.5–1 cm. long.

*Panicles* terminal or occasionally from the upper axils, lax, up to c. 12 cm. long, branches spreading, compressed, pale brown or brownish grey when dry; *flowers* small, sessile, crowded at the ends of the short ultimate branchlets, bracts and bracteoles very small and inconspicuous; buds obovoid, c. 2.75–3.25 mm. long; *calyx* campanulate or obconic, c. 2.25–2.5 mm. long and 2 mm. across mouth, narrowed to a very short stout pseudostalk c. 0.5 mm. long, mouth very obscurely and shallowly 4-toothed; *petals* calyptrate; *stamens* c. 15–30, filaments 0.5–0.75 mm. long, broad and flattened, tapering slightly from base to apex, anthers small, oblong, connective gland small and inconspicuous; style c. 0.5 mm. long, narrowly conical; *ovary* 2-celled.

*Fruit* oblong obovoid, 1.2–1.4 cm. long and 7–8 mm. across at widest point, apex flattened, deeply and narrowly excavate, with very short calyx rim; pericarp fleshy, 3–4

mm. thick; seed more or less globose, c. 4 mm. diam., testa adhering to it but peeling off easily, leaving a thicker inner layer, beneath which is a mucilaginous coat; cotyledons more or less equal, opposing faces folded, with the large hypocotyle, which is grooved along one side, lying in the fold and extending to the periphery of the seed.

This species was described as *E. punctulata* by King, Mat. F.M.P., No. 12, 122 (1901), and Ridley, F.M.P., I, 747 followed King without comment. King's name is a later homonym, being antedated by *E. punctulata* F. M. Bailey (1896). If this were all, only a new name would be required, but the case is complicated because King cited as a synonym *Jambosa "punctulata"* Miq., Fl. Ind. Bat. Suppl. I, 310, which may perhaps be taken as a typographical error for *Jambosa puncticulata*, the only name on p. 310 of Miquel's work that could be meant. King saw Miquel's plant, for he has written on a sheet of *Teymann 3603* in Herb. Calcutta "This is the type sheet" and on the cover enclosing the sheet "*Eugenia puncticulata* Miq." *Jambosa puncticulata* Miq. is not our plant. It differs considerably in the leaves, which are oblong lanceolate, acuminate, with bold, well spaced primary nerves, raised below and impressed above. King's *E. punctulata*, therefore, must be regarded as a *mixtum compositum*. A further, though less important complication, is the fact that King omitted Sumatra, the type locality of Miquel's plant, from the distribution of his *E. punctulata*.

King probably took his specific name from *Syzygium punctulatum* Wall., which he also cited as a synonym, but which, being a *nomen nudum*, has no standing; but it might be argued that *Jambosa puncticulata* Miq. is the basonym, from which King's species must be interpreted, in spite of the fact that what King did describe is a totally different plant. King did not make the transfer of Miquel's name to *Eugenia*, and, as far as I can discover, it never has been transferred. It might be said that King's epithet "*punctulata*" could be a typographical error for "*puncticulata*" in the same way as his citation of Miquel's plant is probably such an error, but with Wallich's name "*punctulata*" available, the supposition does not seem warranted. The epithet "*puncticulata*" is not now available in *Eugenia* for Merrill gave it to a Philippine plant in 1914.

It was therefore thought advisable to start afresh and instead of giving merely a new name to King's plant, to re-describe the species and to indicate a type.

Merrill in Herb. Kew, and with Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 195 (1939) identifies this species with *E. incarnata* Elmer, Leaflets Philipp. Bot., IV,

1416 (1912), of which fruiting specimens only are known from Palawan, Philippine Islands, from an altitude of about 225 m. I have examined type material of *E. incarnata* (Elmer 13231) and although in leaf characters it closely approaches our plant, it differs in having smooth not flaky bark on the twigs, and in its globose much wrinkled fruits which differ rather markedly from the obovoid hardly wrinkled fruits of the Malayan plant. There are other points in Elmer's description which do not fit our plant, one being the colour of the fruits, which are said to be "of a pretty waxy or incarnatus red" and to give the tree a red appearance. Our plant has white or greenish white fruits with no red colour. *E. incarnata* is doubtless allied to *E. cerina*, perhaps closely, but in view of the scanty material available of the former, and of the differences between the two, it seems unwise to assume that they are the same.

***E. cerina* Henderson var. *turbinata* var. nov.**

A typa foliis vulgo minoribus, nervis lateralibus pluribus, subtus plus prominentibus, pseudostipitis calycis longioribus, fructo turbinato differt.

SELANGOR: Sungai Tinggi, Forest Dept. FMS 41652, 44060.

NEGRI SEMBILAN: Singkang, Forest Dept. FMS 4208.

PAHANG: Pekan, Ridley s.n.; Baloh Forest Reserve, Kuantan, Forest Dept. FMS 3615; Sungai Chini, Kuantan, Forest Dept. FMS 4106; Rompin, Forest Dept. FMS 17168; Sungai Bera, near Tasek Bera, SFN 24114 (Henderson); Tasek Bera, SFN 24448 (Henderson).

JOHORE: Kota Tinggi, Ridley 15374, TYPE collection, holotype in Herb. Singapore; Bagan Limau, Sungai Sedili, SFN 23897 (Corner); Danau, Sungai Sedili, Corner s.n.

SINGAPORE: Sungai Morai, Ridley 3983 bis; Sungai Jurong, Ridley 4988; Kranji, Ridley 4989; Bukit Mandai, Ridley 6527; Tampenis, SFN 7616 (Burkill).

This variety usually has smaller leaves than the typical form, with nerves more numerous and more conspicuous below, but these characters are rather variable; the flower buds are more slender (c. 4-4.5 mm. long), the calyx c. 4 mm. long and 2-2.5 across mouth, tapering more gradually, the teeth a little more evident, the stamen filaments a little narrower and not flattened, the style a little shorter. The petals are calyptrate and the ovary 2-locular as in the typical form. The chief difference is in the fruit, which in this variety is turbinate, the apex expanded then abruptly contracted into a swollen stalk which often has a slight kink on one side, c. 1.5 cm. long and 7-8 mm. across the widest part of apex; pericarp fleshy with a fibrous endocarp; seed dark brown, oblong, 6-7 mm. long and 4 mm. across, testa adhering to cotyledons closely, consisting of an outer

fine transparent coat and an inner, thicker, dark brown layer, but without the mucilaginous layer of the typical form; cotyledons more or less as in the typical form, but the hypocotyle not grooved.

*E. cerina* Henderson var. *montana* var. nov.

A *typa floribus maioribus*, lobis calycis conspicuis differt.

TRENGGANU: Gunong Padang, 4,000 feet, *SFN 11883* (*Moysey & Kiah*).

PERAK: Lower Camp, Gunong Batu Puteh, *Wray 1125*.

PAHANG: Fraser Hill, 4,000 feet, *SFN 11208*, TYPE collection, holotype in Herb. Singapore, *SFN 11264* (*Nur*), *Forest Dept. FMS 22537*; Cameron Highlands, *Forest Dept. FMS 25920*.

JOHORE: Gunong Belumut, summit, *Holttum 58* (leaf specimens only).

This variety differs from the typical form in the larger and stouter flower buds, 3.5–4 mm. long, the calyx c. 3–3.25 mm. long, c. 3 mm. wide just below lobes, narrowed rather abruptly into a short stout pseudostalk c. 1 mm. long, lobes evident, broad and rounded, incurved over petals in bud and persisting as triangular points after anthesis; petals calyptrate, but the calyptra much thicker than in the typical form or in var. *turbinata*; stamen filaments more tapered to apex. Ovary 2-celled. Fruit unknown. The bark is described by the collector of the type specimens as brownish greyish dull, slightly flaky, not fissured or rugose.

86. *Eugenia avenis* (Miq.) comb. nov. (Fig. 32a).

*Syzygium avene* Miq., Fl. Ind. Bat. Suppl. I, 312 (1860). *Syzygium scoparium* Wall. Cat. 3594, nom. nud. *Eugenia scoparia* Duthie in Hook. fil., F.B.I., II, 489 (1878); King, Mat. F.M.P., No. 12, 125; Ridl., F.M.P., I, 748.

MALACCA: Merlimau, *Goodenough 1649*.

JOHORE: Hadji Senawi, *Ridley 11055*.

SINGAPORE: sine loc., *Wallich 3594*.

*Distrib*: Sumatra.

A ? tree. Twigs slender, terete, with a smooth polished papery pale yellow layer which flakes off and reveals pale reddish brown bark beneath. Leaves coriaceous, oblanceolate, narrowly obovate, or oblong- or elliptic-lanceolate, apex acute or shortly acuminate, base cuneate, up to c. 7 cm. × 2.5 cm., upper surface somewhat polished, drying brown to dark brown, minutely and closely punctate, lower surface dull and paler with close minute dark glands; midrib narrowly impressed above, elevate below; primary nerves numerous and close together, very slightly raised on both

surfaces and almost invisible, meeting in a very obscure intramarginal nerve close to leaf margin; petiole usually less than 5 mm. long.

*Panicles* terminal or from upper axils, up to c. 4 cm. long, peduncle slender, 4-angled, usually long, with a few divaricate, short, slender, 4-angled, laxly flowered branches near its apex; *flowers* in threes at apices of short ultimate branchlets, the centre flower sessile, the outer ones on distinct pedicels c. 1 mm. long; buds clavate, c. 2.5–3 mm. long; *calyx* after anthesis rather widely funnel shaped, c. 2.5 mm. long, contracted rather abruptly at base into a pseudostalk c. 0.5 mm. long; lobes 4, short broad and rounded, incurved in bud, persistent; *petals* falling in a thick flat quadrangular calyptra; *stamens* few (c. 20), filaments short, subulate above, flattened at base, anthers elliptic, c. 0.2–0.3 mm. long.

*Fruit* more or less globular, c. 4 mm. diam., apex broad, convex, not excavate, with the very short calyx rim c. 2.5 mm. diam., and remains of calyx lobes.

King reduced *S. avene* Miq. to *E. scoparia* Duthie, but Wallich's name is a *nomen nudum* which was not validated, by Duthie, until 1878. Miquel's name is therefore older. I have compared a "duplicate type" of *S. avene* Miq. from Leiden and another sheet of the same collection (Sumatra, Priaman, *Diepenhorst H.B. 3083*) in Herb. Calcutta with a sheet of *Wallich 3594*, also in Herb. Calcutta. Although Wallich's specimen is in fruit and the others in flower, there can be little doubt that they are conspecific. The other collections cited above match the Sumatran plant reasonably closely.

*E. avenis* is probably allied to *E. cerina*, and also to *Syzygium nigropunctatum* Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 195, as these authors point out, but it differs from the latter in the narrower longer leaves and longer inflorescence branchlets.

87. *Eugenia Goodenovii* King, Mat. F.M.P., No. 12, 117 (1901); emend.; Ridl., F.M.P., I, 731, pro parte. (Fig. 32b).

PERAK: near Ulu Selangor, 500–700 feet, *Kunstler 8741*.

MALACCA: Ayer Kroh, *Goodenough 1759*, lectotype.

*Distrib.* Endemic.

A tree. Youngest *twigs* slender, compressed or 4-angled, older ones terete, bark smooth becoming slightly flaky, drying pale yellowish grey. *Leaves* thickly coriaceous, narrowly elliptic, apex shortly acuminate, base narrowly cuneate, up to c. 12 cm. × 4 cm., both surfaces drying brown, the upper somewhat polished, obscurely

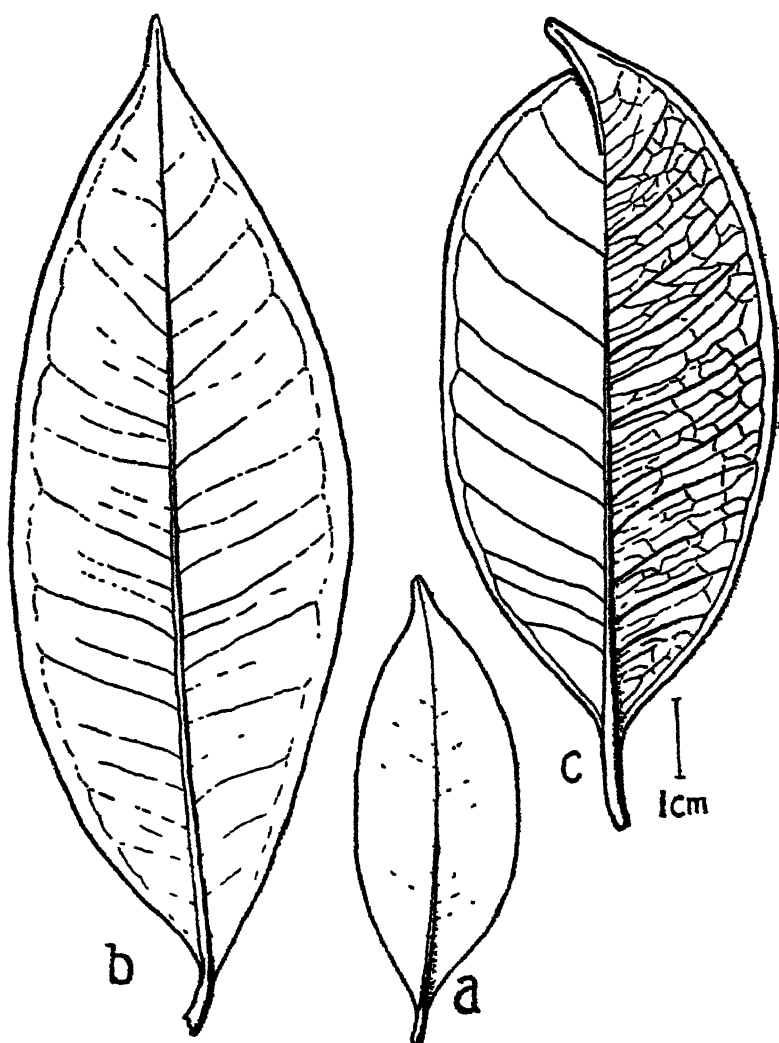


Fig. 32. a, *E. avenis*; b, *E. Goodenovii*; c, *E. Curtisi*.

punctate, the lower dull, not glandular; midrib shallowly impressed above, smooth and shining and elevate below; *primary nerves* about 12 pairs, c. 1 cm. apart, curving up to an intramarginal nerve c. 3 mm. from leaf margin, very obscure on both surfaces or invisible above; secondaries slightly fainter than primaries, reticulations not visible; petiole rather stout, channelled above, c. 5 mm. long.

*Panicles* terminal and from upper axils, short and rather densely flowered, c. 4 cm. long, usually branched from base, the branches short, spreading, angled, with brownish wrinkled bark, bracts and bracteoles small, broad and rounded, persistent; *flowers* usually in threes at branchlet ends, on pedicels c. 2 mm. long, or sometimes the central flower of the triads sessile; *calyx* nearly 1 cm. long, funnel shaped and tapered to base and rather suddenly contracted into a pseudostalk c. 1.5 mm. long; lobes 4, unequal, the two outer thick textured, broad and rounded, c. 3 mm. across and 2.5 mm. tall, the two inner rather thinner with thin margins, pellucidly gland dotted, c. 5 mm. across and 4.5 mm. tall; *petals* 4, falling as a calyptra, but not agglutinated and easily separable, orbicular, pellucidly gland dotted, c. 6 mm. diam.; *stamens* numerous, anthers on oblong, c. 0.7 mm. long, connective gland inconspicuous; *ovary* 2-celled, multiovulate.

As noted under *E. rugosa* (Korth.) Merr., King's species is a mixture, for he included under it *Syzygium rigidum* Wall. Cat. 3581, which is *E. rugosa*, one of the clavate flowered group related to *E. attenuata*, and quite different from the specimens quoted above which have a funnel shaped calyx with conspicuous lobes. I have therefore retained King's name for the latter group, selecting *Goodenough 1759* as the type.

88. *Eugenia Curtisii* King, Mat. F.M.P., No. 12, 129 (1901); Ridl., F.M.P., I, 749. *E. coralina* Merr. in Journ. Roy. As Soc. Str. Br., LXXVII, 207 (1917); loc. cit., LXXIX, 20 (1918). *Syzygium Curtisii* (King), Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 182 (1939). (Fig. 32c).

PERAK: Sepatang, Wray 2968 (syntype); Taiping Wray 3102 (syntype); Gopeng, 300-500 feet, Kunstler 6149 (syntype).

PAHANG: Sungai Bera near Tasek Bera, SFN 24110 (Henderson).

JOHORE: Kangka Sedili Ketchil, SFN 28622 (Corner).

Distrib: Sumatra, Borneo.

A tree up to c. 25 m. tall; trunk fluted at base; bark very slightly papery flaky, appearing smooth and entire, with persistent leaf scars, pinkish fawn to pale rufous fawn; inner bark pale fawn cinnamon darkening on exposure as does the yellowish wood. *Twigs* terete, bark drying dark brown, flaky. *Leaves* coriaceous, oblong elliptic or oblong lanceolate, occasionally oblanceolate, apex acuminate, base cuneate, from c. 5 cm. to 12 cm. long and 2 cm. to 5 cm. wide, upper surface drying greenish brown or olivaceous brown to nearly black, shining, obscurely punctate or glandular pustulate, lower surface dull and

paler with minute close dark or concolorous pustulate glands; midrib narrowly impressed above, elevate and pustulate below; *primary nerves* up to 20 or 25 pairs, spreading and nearly straight, meeting in a nearly straight intramarginal nerve c. 2 mm. from the recurved leaf margin, usually raised on both surfaces, indistinct above, fine but distinct below, the secondaries and reticulations somewhat less distinct; petiole up to c. 1 cm. long.

*Panicles* terminal, occasionally from upper leaf axils, branched from the base, dense, corymbose, rachis, branches and branchlets rather stout, with reddish brown rugose-granular bark flaking in small square pieces; *flowers* sessile, densely crowded at the ends of the ultimate branchlets, buds globose clavate or obovoid, 4-6 mm. long; *calyx* after anthesis funnel shaped or widely campanulate, granular, 4-5 mm. long and c. 3 mm. across mouth, contracted rather suddenly at base into a rather slender pseudostalk 1-2 mm. long; lobes 5, broadly triangular, c. 1 mm. across and 0.5 mm. tall, deciduous; *petals* 5, falling as a calyptra but easily separable, orbicular, conspicuously pellucidly gland dotted, the outer one c. 3 mm. diam., the inner ones slightly smaller; *stamens* numerous, reaching 8-9 mm. long, filaments slender, subulate, anthers ovate oblong to orbicular, c. 0.4 mm. long, connective gland distinct; *style* stouter than filaments, c. 7 mm. long; *ovary* 2-celled, multiovulate.

*Fruit* depressed globose to nearly reniform and flattened laterally, or globose, up to c. 1.8 cm. broad and 1 cm. tall, surface shining or dull red brown when dry, smooth or minutely rugulose or pitted, apex with tubular remains of calyx tube c. 1.5-2 mm. tall and 3 mm. diam.; pericarp leathery, c. 1 mm. thick; seed 1, conforming to shape of fruit, cotyledons without testa, nearly equal, attached to hypocotyle by short broad stalks.

**E. Curtisii** King var. *minor* King, Mat. F.M.P., No. 12, 129 (1901).

PERAK: Tapah, Wray 194 (syntype).

MALACCA: sine loc., Harvey s.n. (syntype).

PAHANG: Bentong, Forest Dept. FMS 3912; Rompin, Forest Dept. FMS 17104.

This differs from the type in having the inflorescence branches dark red rugose scurfy, not scaly flaky, the flowers either without pseudostalk or with a very short (c. 0.5 mm.) pseudostalk, the buds smaller (c. 3 mm. long), the leaves a little more oblong, upper surface smooth, not pitted, occasionally slightly pustulate, lower surface pustulate.

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**E. Curtisii** King var. **Holttumii** (Ridl.) var. nov.

*E. Holttumii* Ridl. in Journ. Bot., 296 (1924); F.M.P., V, Suppl., 309.

PAHANG: Fraser Hill, 4,000–4,370 feet, Forest Dept. FMS 7751 (*Burkill & Holttum*); Boh Plantations, Cameron Highlands, 4,000 feet, SFN 32666 (*Nur*).

Although *E. Curtisii* is not a well-known or common species, there is sufficient variability in the collections to justify the inclusion of *E. Holttumii* as a mountain variety.

The variety differs from the typical form in the generally smaller leaves (2–7 cm.  $\times$  1–1.25 cm.) somewhat more closely nerved, the more abrupt contraction of the calyx into a very short (0.5 mm.) pseudostalk (the flowers are sessile, not pedicelled as Ridley described them) and the very small calyx lobes produced into subulate points.

89. **Eugenia setosa** King, Mat. F.M.P., No. 12, 120 (1901); Ridl., F.M.P., I, 755. (Fig. 33a).

PERAK: Taiping, Wray 2704 (syntype); Larut, within 100 feet, Kunstler 5447, 6202, 6601 (syntype), within 300 feet, Kunstler 5266, 6793 (syntypes).

SELANGOR: Sungai Tinggi, Kuala Selangor, SFN 34068 (*Nur*), Forest Dept. FMS 44033.

Distrib: Endemic.

A shrub or small tree or ? a climber. Twigs slender, terete, densely reddish scurfy and coarsely hairy with spreading subulate hairs. Leaves thinly coriaceous, oblong lanceolate or narrowly oblong, apex abruptly acuminate or caudate acuminate, the acumen up to c. 1.5 cm. long, base rounded, up to c. 8 cm.  $\times$  2.75 cm., upper surface somewhat polished, drying greenish or olivaceous brown, minutely punctate or pustulate, lower surface greenish brown to dark brown, minutely and closely pustulate; midrib narrowly impressed above, elevate below and clothed with coarse subulate spreading hairs; primary nerves numerous (up to c. 35 pairs) and close together, subhorizontal, meeting an intramarginal nerve less than 1 mm. from the somewhat undulate and recurved leaf margin, slightly raised and very fine and faint on both surfaces, the secondaries and lax reticulations hardly visible above, slightly fainter below than primaries; petiole very short, 2–3 mm., leaves appearing sessile.

Panicles terminal or from upper leaf axils, up to c. 8 cm. long, on long peduncles, branches numerous, slender, spreading, all covered with the same reddish scurf and coarse hairs as twigs; flowers rather crowded on the short ultimate branchlets, white, sessile, bracts and bracteoles minute, narrowly triangular acute, subpersistent, buds globose clavate; calyx campanulate, c. 5 mm. long and 3 mm.

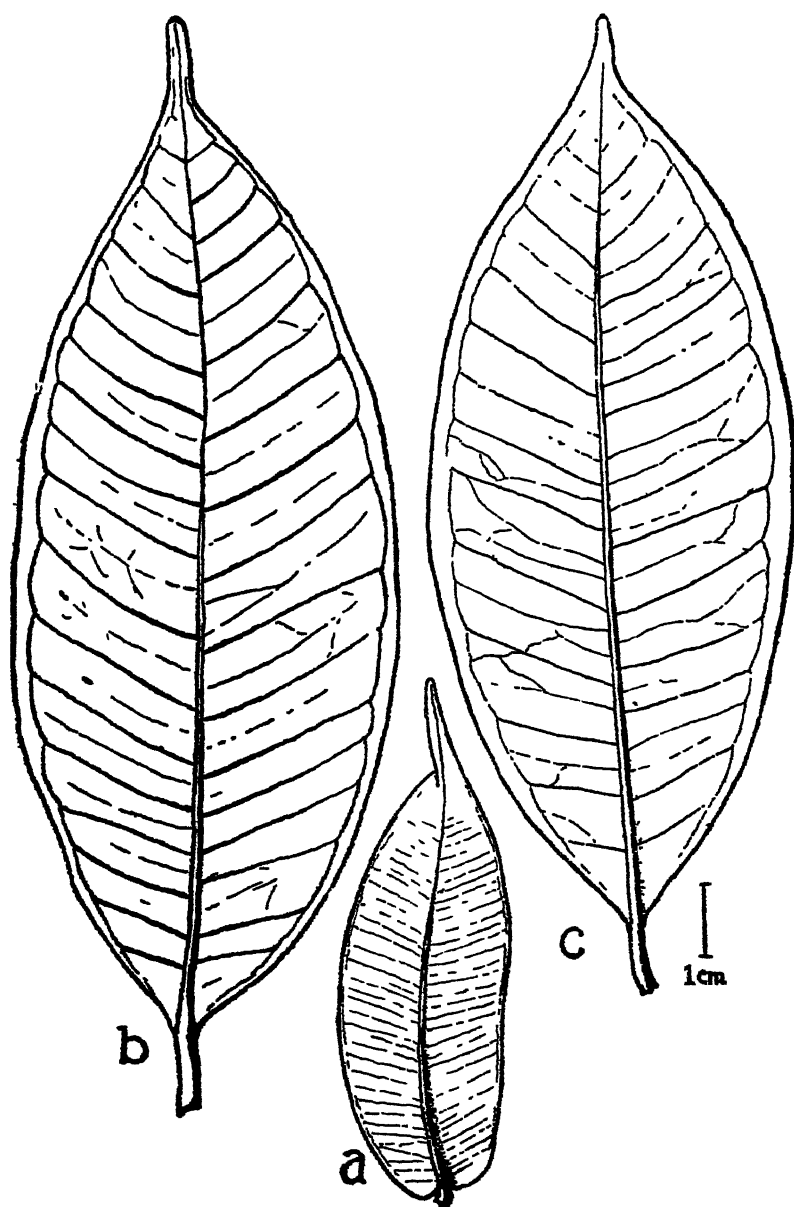


Fig. 33. a, *E. setosa*; b, *E. pauper*; c, *E. Klossii*.

across mouth, contracted about the middle into a rather slender pseudostalk c. 2 mm. long; lobes 5, deciduous, broadly triangular acute, less than 1 mm. across and 0.5 mm. tall; *petals* 5, probably falling as a calyptra, but the outer two free, orbicular, c. 2 mm. diam., pellucidly gland dotted, the inner three partially agglutinated; *stamens* numerous, filaments slender, subulate, up to c. 4 mm. long, anthers narrowly ovate, c. 0.4 mm. long, connective gland small but distinct; *style* stouter than filaments, glandular pustulate, c. 6 mm. long; *ovary* 2-celled.

*Fruit* turbinate, crowned by the small truncate calyx rim, covered with minute pellucid granule-like glands, diam. c. 9 mm. (ex King).

This species is allied to *E. Curtisii* var. *minor* and var. *Holttumii*, but it differs markedly in the rounded base of the leaf, the scurfy and coarsely hairy twigs and inflorescence branches, the different calyx lobes and the longer pseudostalk.

Several of Kunstler's collections are described on their labels as "creepers" clinging to stems of trees. The other collections cited, where a field note was made, are described as shrubs or small trees. If Kunstler made a mistake, it is curious that he did so more than once.

90. *Eugenia pauper* Ridl. in Journ. Roy. As. Soc. Str. Br., LXXIX, 65 (1918); F.M.P., I, 745. (Fig. 33b).

NEGREI SEMBILAN: Gemas, SFN 4481 (Burkill).

JOHORE: Gunong Pulai, Ridley 12175 (syntype); Gunong Panti, Ridley 4200 (syntype), cited by King under *E. pendens* Duthie; Sungai Tebrau, Ridley 13219; Mount Austin, Ridley 11992; Pulau Tinggi, SFN 939 (Burkill); Sungai Pelepah, SFN 20005 (Nur); Sungai Berassau, Mawai-Jemaluang road, SFN 28978 (Corner); Ulu Segun, Gunong Panti, SFN 30697 (Corner).

SINGAPORE: Serangoon road, Ridley 8411, 8412; Bukit Timah, Ridley s.n., 8449 (cited by King under *E. variolosa* King), 14136; Botanic Gardens, Ridley 6915, 6915a, 8944; Reservoir Jungle, SFN 32529 (Corner).

*Distrib.*: Endemic.

A small tree or treelet up to c. 7 m. tall, trunk slightly stilted at base; bark slightly papery flaky, pale rufous; inner bark pallid brownish, green below surface, very thin. Twigs slender, terete, bark reddish brown. Leaves thin, dark green in life and pale beneath, broadly or narrowly elliptic, occasionally elliptic oblong, up to c. 18 cm. long and 7 cm. broad but usually smaller, apex cuspidate, the acumen varying much in length; base cuneate; petiole finely wrinkled, deeply and narrowly channelled above, variable in length from c. 5 cm. to 1.5 cm.; primary nerves usually between 10 and 16 pairs, finely impressed above, raised below and very distinct, from 6 mm. to 2 cm. apart, curving

very gently or running nearly straight to a well marked intramarginal nerve 2–5 mm. from leaf margin; secondaries and reticulations obscure or invisible above, when visible slightly raised, slender and raised below, much less bold than primaries; upper surface usually drying dark or blackish brown, sometimes minutely and densely punctate; lower surface paler, brown, usually minutely pustulate or black dotted.

*Inflorescences* terminal or axillary, short, reaching 2 cm. long but usually less, rather dense, branchlets slender, dark coloured with sessile flowers in threes or more at their apices, bracts and bracteoles minute, subpersistent; *calyx* tube cupshaped, c. 5–6 mm. long, narrowed abruptly into a rather slender pseudostalk c. 2.5 mm. long, mouth of calyx truncate; *petals* falling in a calyptra c. 4 mm. diam., gland dotted, the petals closely adhering and usually only the outer one separable from the others; *stamens* numerous, filaments slender, terete, varying much in length from 1.5 mm. to c. 6 mm., anthers small with a rather conspicuous dark coloured connective gland; *style* much stouter than filaments, subulate, 8–9 mm. long.

*Fruit* globose c. 1 cm. diam., the apical calyx rim rather prominent, c. 1 mm. tall and 2 mm. diam.

I can hardly agree with Ridley's remark in the original description that the inflorescence of this species exactly resembles that of *E. oblata* Roxb. *E. oblata* has very much larger, usually terminal inflorescences, while its flowers are also larger with very definite calyx lobes.

91. *Eugenia Klossii* Ridl. in Journ. Roy. As. Soc. Str. Br., LXXIX, 65 (1918); F.M.P., I, 744. (Fig. 33c).

SELANGOR: Rantau Panjang, *Kloss 25* (type collection).

*Distrib.*: Endemic.

A tree. *Twigs* slender, the youngest angled, the older terete, bark dark. *Leaves* thinly coriaceous, narrowly elliptic or oblong elliptic, apex acuminate acute, base cuneate, c. 14 cm. long and 6 cm. wide; midrib impressed above, elevate below; *primary nerves* 15–20 pairs, 5–7 mm. apart, meeting a shallowly looped intramarginal nerve c. 2–3 mm. from leaf margin, indistinct above, elevate below; petiole up to c. 7 mm. long.

*Panicles* terminal, up to c. 6 cm. long, lax and few flowered, the rachis and few spreading branches slender; *flowers* solitary or in twos or threes at branchlet ends; *calyx* broadly campanulate, c. 6–7 mm. long, 4–5 mm. across mouth, rather quickly contracted into a slender pseudostalk 3–4 mm. long, mouth truncate; *petals* calyptrate; *stamens* numerous, up to c. 1 cm. long, *style* about as long.

Known only from one collection. Perhaps allied to *E. pendens*, but with much smaller flowers. Merrill and Perry state that the Bornean record of this species is based on an erroneous determination.

92. *Eugenia valdevenosa* Duthie in Hook. fil., F.B.I., II, 489 (1878); King, Mat. F.M.P., No. 12, 111; Ridl., F.M.P., I, 743; Corner, Wayside Trees of Malaya, p. 504, fig. 168. *Syzygium valdevenosum* (Duthie) Merr. & Perry in Mem. Amer. Arts & Sci., XVIII, 3, 182 (1939). *Eugenia alata* Ridl. in Journ. Roy. As. Soc. Str. Br., LXXXVI, 293 (1922); F.M.P., I, 743. (Fig. 34b).

Common from Penang to Johore in lowland and hill forest, and in wet forest in Johore. One collection from a sapling at Bukit Timah, Singapore may be this species.

*Distrib*: Sumatra (*Krukoff* 4390, 4406), Borneo.

A tree, trunk not buttressed; bark entire or very faintly and shortly creviced or very finely fissured longitudinally, not flaky, pale greyish drab or greyish yellowish, very faintly pinkish; inner bark deep pink brown to red brown or blood red; sapwood white, heartwood pinkish brown, very hard. *Twigs* rather stout, obtusely 4-angled or nearly terete, or acutely 4-angled with narrow wings, bark smooth, brown when dry. *Leaves* coriaceous, elliptic or oblong elliptic, sometimes obovate, apex shortly and abruptly acuminate, base cuneate or sometimes rounded, from c. 11–28 cm. long and 5–11 cm. wide, upper surface drying olivaceous brown to blackish brown, lower surface reddish brown with or without minute scattered gland dots; midrib impressed above, prominent below; *primary nerves* from c. 10–24 pairs, 1–2 cm. apart, slightly raised and rather fine above, prominent below, basal ones nearly straight and slightly ascending, upper ones curving up to a prominent intramarginal nerve 3–5 mm. from leaf margin, with a much fainter series of loops close to the margin; secondaries and reticulations slightly raised and very fine above, elevate below but considerably less prominent than primaries, the reticulations lax; petiole up to c. 1.5 long, rather slender.

*Panicles* terminal or from upper leaf axils, pedunculate, usually shorter than leaves but reaching c. 25 cm. long in fruit, often clustered, rather lax, with many spreading, slender, much compressed branches; *flowers* white, sessile, in threes or clusters at the ends of the rather long and slender ultimate branchlets, buds narrowly clavate, 8–9 mm. long; *calyx* rather narrowly funnel shaped, tapered rather gradually into a slender pseudostalk c. 3–4 mm. long, mouth truncate, without lobes, c. 2.5 mm. across; *petals* falling as a hemispherical calyptra c. 2.5 mm. diam., not completely

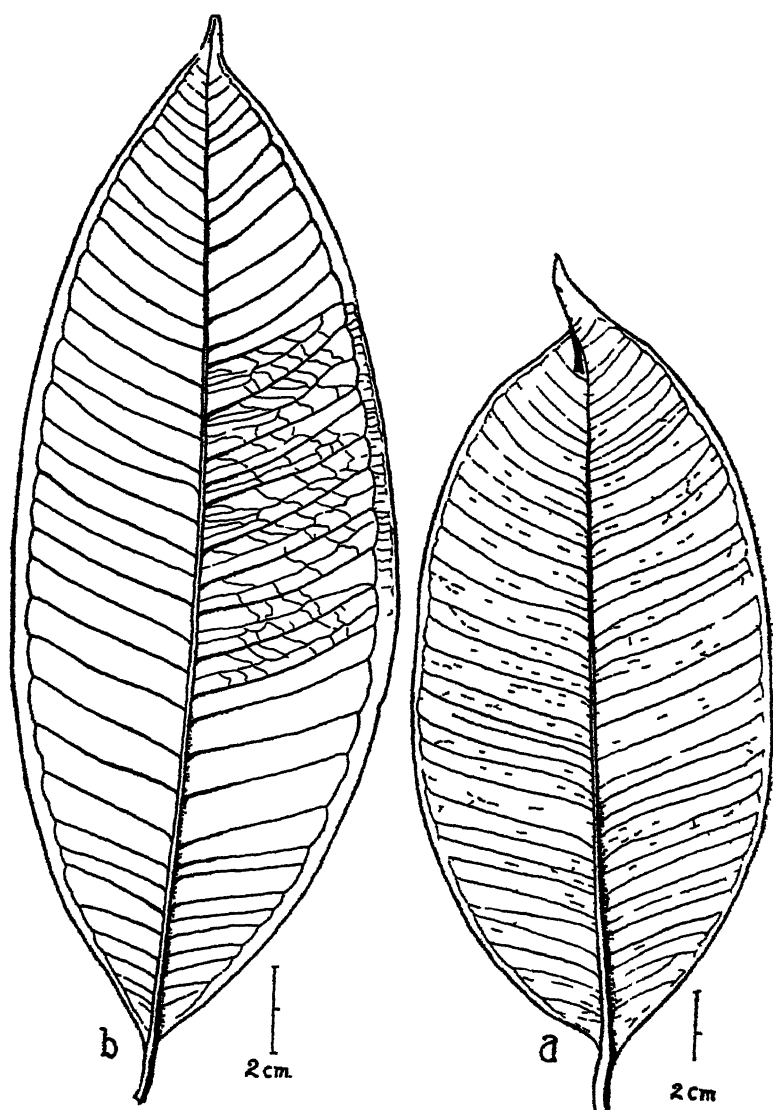


Fig. 34 a, *E. quadribacteata*; b, *E. valderenosa*.

agglutinated; *stamens* numerous, filaments very slender, up to c. 13 cm. long, anthers broadly elliptic, c. 0.4 mm. long, connective gland small; *style* much stouter than filaments, 6–7 long; *ovary* 2-celled.

*Fruit* ripening pale green or whitish, more or less oblong globose or depressed globose, c. 1.8 cm. diam., apical umbilicus 3–4 mm. diam., rather deep, with persistent style base, the calyx rim not conspicuous; pericarp 2–3 mm. thick, testa adhering loosely to it; cotyledons more or less equal, surface rugose, inner faces somewhat concave, attached to hypocotyle near their centres by very broad short stalks.

93. *Eugenia Cumini* (L.) Druce in Report. Bot. Exch. Club Brit. Isles, III, 418 (1914); Craib, Fl. Siam. Enum., I, 637; Corner, Wayside Trees of Malaya, p. 496, fig. 168. *Myrtus Cumini* Linn., Sp. Pl., 471 (1753). *Syzygium Cumini* (L.) Skeels in U.S. Dept. Agric. Bur. Pl. Ind. Bull., 248, 25 (1918); Merr. & Perry in Journ. Arn. Arb., XIX, 108. *Eugenia jambolana* Lamk., Encycl., III, 198 (1789); Duthie in Hook. fil., F.B.I., II, 499; King, Mat. F.M.P., No. 12, 131; Gagnep. in Fl. Gen. Indo-Ch., II, 818; Koord. & Valet., Atlas Baumart. Java, III, fig. 496; Ridl., F.M.P., I, 754. (Fig. 35).

A tree up to c. 20 m. tall; bark scaly with thin often transversely elongated large or small papery pieces, light greyish white, inner bark thick, pale brown. *Twigs* slender, terete, smooth, pale yellowish grey or whitish when dry. *Leaves* coriaceous, oblong ovate or elliptic oblong or ovate rotund, apex rather shortly and abruptly acuminate or obtuse or rounded, base broadly cuneate or rounded and abruptly and shortly narrowed to petiole, from c. 7–18 cm. long and 3–8.5 cm. broad, upper surface drying brown to blackish brown, shining, minutely punctate, lower surface dull and paler, minutely pitted or pustulate; midrib impressed above, elevate below; *primary nerves* rather numerous (to c. 30 pairs), usually about 5 mm. apart, rather irregular, meeting in an irregularly looped intramarginal nerve c. 2 mm. from leaf margin, raised on both surfaces and fine, but more distinct below, the secondaries and closely netted reticulations below almost as distinct as primaries and so giving the effect of numerous and close primaries; petioles slender, reaching 2.5 cm. long.

*Panicles* usually from twigs below leaves, occasionally terminal or from upper leaf axils, up to c. 12 cm. long, long peduncled with several pairs of distant horizontal slender terete or slightly angled striate branches; *flowers* white, the calyx rose pink after anthesis, sessile in rather dense heads at ends of branches or in clusters at ends of short branchlets, buds globose clavate, 5–6 mm. long; *calyx* with fine raised gland dots, 4–5 mm. long, c. 3.5 mm. across mouth, narrowly campanulate, rather suddenly contracted into a stout pseudostalk c. 2 mm. long; lobes in bud 4,

broad, thin and obscure, quickly deciduous and leaving a truncate limb; *petals* falling in a flat, orbicular, gland dotted calyptra c. 2.5 mm. diam.; *stamens* numerous, filaments slender, subulate, very finely punctate, up to c. 6 mm. long, anthers oblong ovate 0.6–0.7 mm. long, connective gland

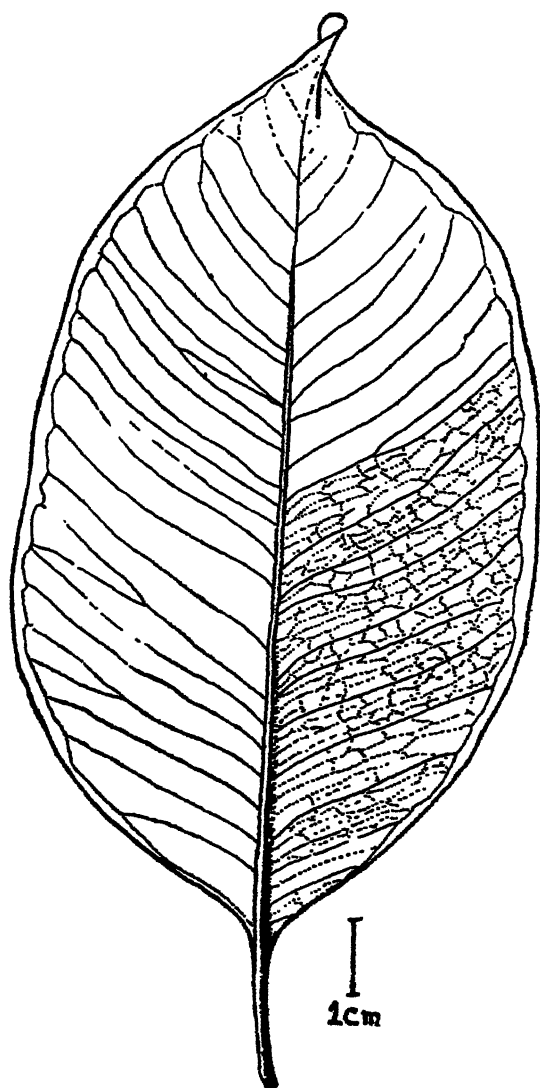


Fig. 35. *E. Cumini*.

small but distinct; *style* subulate, much stouter than filaments and finely punctate like them, 6-7 mm. long; *ovary* 1-celled, multiovulate.

*Fruit* black when ripe, edible, oblong to oblong elliptic, more or less oblique, c. 2 cm.  $\times$  1.75 cm., apical calyx rim prominent, c. 2 mm. tall, umbilicus narrow and deep, c. 2-3 mm. diam.; pericarp pulpy, c. 2-3 mm. thick, seed ellipsoid or oblong ellipsoid, c. 1.25 cm.  $\times$  0.75 cm., testa rather thick, more or less crustaceous, adhering closely to the smooth surface of the cotyledons; cotyledons unequal, one about one-third the size of the other, or nearly equal, conspicuously gland dotted, superposed, sessile, attached to the short broad hypocotyle near the periphery, face of the larger cotyledon concave, of the smaller convex, not interlocking or folded, or nearly plane with a short upcurved fold near point of attachment.

There is no evidence to show that this species is indigenous to the flora of Malaya. It has been collected only in the vicinity of towns and villages.

94. *Eugenia oblongifolia* Duthie in Hook. fil., F.B.I., II, 491 (1878); King, Mat. F.M.P., No. 12, 111, incl. var. *parviflora* King, excl. var. *robusta* King; Ridl., F.M.P., I, 744. (Fig. 36a).

PERAK: Gopeng, 500-800 feet, *Kunstler 6012*; near Ulu Kerling, 500-800 feet, *Kunstler 8848*; near Ulu Selangor (? or Slim), 400-600 feet, *Kunstler 10883*; Gunong Haram Parah, *Scortechini 618*.

MALACCA: sine loc., *Maingay K.D. 746* (type collection), *Ridley 1503c, 1505c*.

NEGRI SEMBILAN: Telok Kemang, *Forest Dept. FMS 4210*.

SINGAPORE: Chan Chu Kang, *Ridley 360, 4993*; Gardens Jungle, *Ridley 10131*; McRitchie Reservoir, *Corner s.n.*

*Distrib.* Endemic.

A tree up to c. 18 m. tall; bark becoming slightly scaly, brownish pink, very like that of *E. longiflora*; inner bark red. *Twigs* rather slender, youngest 4-angled or compressed, older nearly terete, smooth, drying pale brown. *Leaves* thinly coriaceous, elliptic or oblong elliptic, sometimes oblong lanceolate or oblanceolate, apex acuminate, often abruptly so, base cuneate or more or less rounded and shortly narrowed to petiole, from c. 6-10 cm. long and 2.5-5 cm. broad; upper surface drying olivaceous brown, shining, lower brown to reddish brown; midrib impressed above, elevate below and more or less keeled; *primary nerves* c. 10-14 pairs, spaced, very slender, raised and distinct on both surfaces, often pale, spreading and rather irregular, meeting in a very shallowly looped intramarginal nerve 1-3 mm. from leaf margin; secondaries and reticulations raised on both surfaces and distinct, usually slightly less prominent than primaries; petiole c. 5 mm. long.

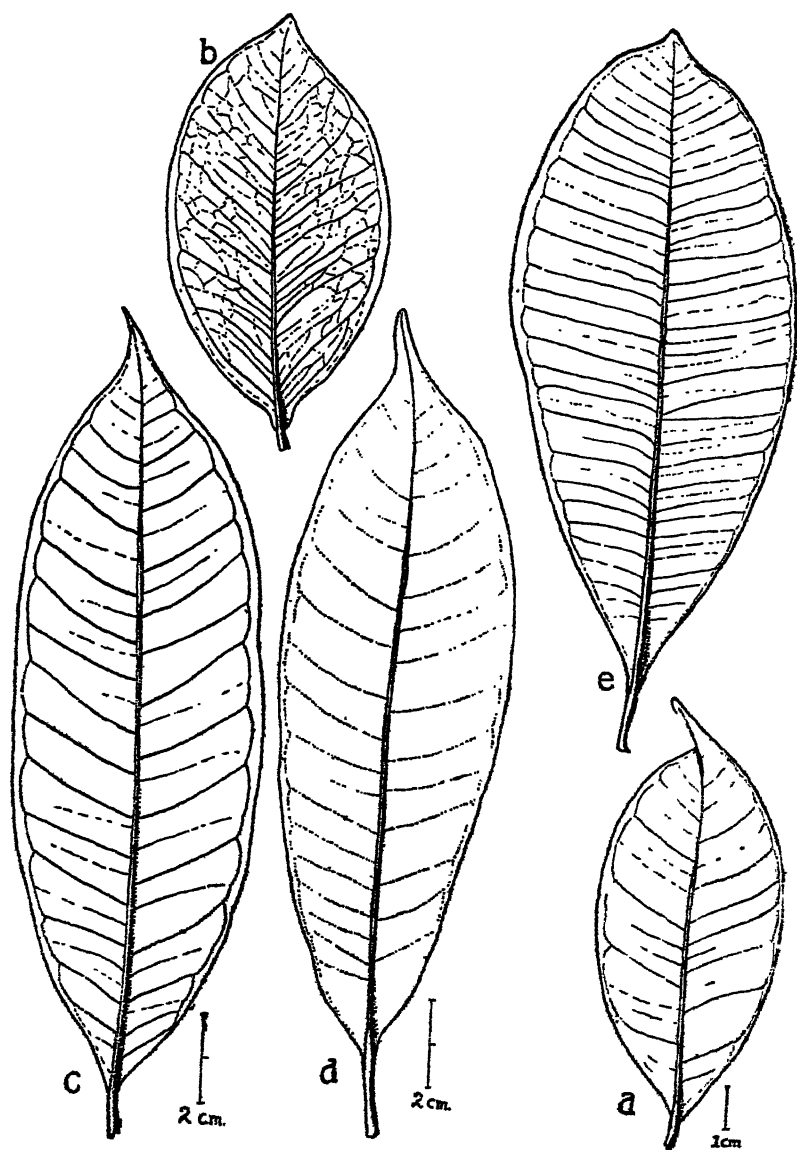


Fig. 36. a, *E. oblongifolia*; b, *E. Muelleri*; c, *E. pustulata*; d, *E. chloroleuca*; e, *E. fastigiata*.

*Panicles* terminal or from upper axils, corymbose, sometimes several together, peduncled, reaching c. 10 cm. long and as wide, the rather stout peduncle and rather slender numerous branches more or less 4-angled, the numerous branchlets slender, compressed, all with pale brown striate bark; *flowers* white or cream colour, sessile, usually in threes at branchlet ends; buds narrowly globose clavate, c. 7-8 mm. long; *calyx* c. 7 mm. long, c. 3 mm. across mouth, striate when dry, narrowly campanulate, tapering into a slender pseudostalk c. 4 mm. long, mouth in bud with 4 very shallow oblong obscure lobes, truncate after anthesis; *petals* falling in a depressed calyptra c. 2.5 mm. diam.; *stamens* numerous, filaments slender, up to c. 7 mm. long, anthers broadly oblong ovate, c. 0.3-0.4 mm. long, connective gland very small and inconspicuous; *style* stouter than filaments, 4-5 mm. long; *ovary* 2-celled.

*Fruit* depressed globose or transversely oblong globose, pale green when ripe, c. 1.7 cm. diam., apex with a narrow and rather deep excavation c. 3 mm. diam., fringed by the inconspicuous calyx rim; pericarp thin, seed 1, testa rather thick and crustaceous, adhering closely to cotyledons; cotyledons side by side, somewhat unequal, inner faces more or less concave, gland dotted, attached to hypocotyle near their centres by short broad stalks.

95. *Eugenia Muelleri* Miq., Anal. Bot. Ind., I, 23, tab. 6 (1850). *E. venulosa* Duthie in Hook. fl., F.B.I., II, 490 (1878); King, Mat. F.M.P., No. 12, 123, incl. var. *macrothyrsa* King; Ridl., F.M.P., I, 746; Corner, Wayside Trees of Malaya, p. 504, fig. 168. *Syzygium venulosum* Wall. Cat. 3585 nom. nud. *Syzygium Muelleri* Miq., Fl. Ind. Bat., I, i, 453 (1855); Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 186. (Fig. 36b).

Not uncommon from Perak to Singapore in lowland forest, commonest in South Johore and Singapore, often by streams. *Distrib*: Borneo; Karimon Islands (fide Ridley).

A tree reaching c. 22 m. tall, trunk narrowly fluted up to c. 2.4 m. from ground or only at base, slightly stilt rooted or not; bark nearly smooth, becoming rather finely creviced, flaky in irregular small pieces, light grey or greyish brown; inner bark light pinkish brown, wood pale brown. *Twigs* slender, terete, smooth, drying whitish to pale brown. *Leaves* coriaceous, elliptic or elliptic rhomboid or oblanceolate or obovate, apex obtuse or subacute, base cuneate or shortly and abruptly narrowed to petiole, from c. 5 cm. ×

3 cm. or occasionally smaller to c. 11.5 cm.  $\times$  5.5 cm., dark green to yellowish green, shining above, dull and paler below, upper surface drying olivaceous brown or leaden brown to nearly black, shining, minutely punctate or rugulose pustulate, lower surface paler, usually reddish brown, sometimes minutely pustulate; midrib shallowly depressed above, elevate and keeled below; *primary nerves* c. 7-14 pairs, c. 0.5-1 cm. apart, ascending rather irregularly to a nearly straight intramarginal nerve c. 2-3 mm. from leaf margin, raised and slender and distinct on both surfaces, the secondaries and lax reticulations also raised on both surfaces and a little less prominent than primaries; petiole about 5 mm. long, the leaf blade sometimes decurrent upon it.

*Panicles* terminal, broadly corymbose, peduncled or branched from base, up to c. 10 cm. long and 14 cm. across, often much smaller, much branched, the branches and branchlets slender, spreading, 4-angled, ultimate branchlets compressed; *flowers* white, the calyx greenish or tinged reddish, sessile in threes at ends of ultimate branchlets, buds clavate, up to 7 mm. long; *calyx* 5-6 mm. long, campanulate, rugulose and ridged, rather suddenly contracted into a pseudostalk rather variable in length and thickness but usually slender and c. 3-4 mm. long, mouth truncate or with very shallow and very obscure lobes; *petals* falling in a pellucidly gland dotted calyptra c. 3 mm. diam., almost entirely or entirely agglutinated; *stamens* numerous, filaments slender, subulate, reaching 7-8 mm. long, anthers ovate oblong, c. 0.4 mm. long, connective gland conspicuous; *style* much stouter than filaments, c. 7 mm. long; *ovary* 2-celled.

*Fruit* when ripe green, the exposed side suffused purple, globose, faintly vertically ridged, c. 1.3 cm. diam., apical umbilicus c. 4 mm. diam., without calyx rim; pericarp leathery, seed 1, testa pale brown, tough, cotyledons slightly unequal, inner faces gland dotted, nearly plane except for a triangular projection on the periphery of the smaller fitting into a recess on the other, attached near their centres to the hypocotyle by very short broad stalks: in one seed examined a small area of the opposing faces fused together.

I have not seen the type of *E. Muelleri* Miquel, but Miquel's descriptions and figure fit our plant, and Merrill and Perry, the former of whom has examined the type, have no hesitation in making the reduction of Duthie's species.

96. *Eugenia pustulata* Duthie in Hook. fil., F.B.I., II, 495 (1878); King, Mat. F.M.P., No. 12, 127; Ridl., F.M.P., I, 736. *E. perpuncticulata* Merr. in Univ. Calif. Publ. Bot., XV, 220 (1929). *Syzygium perpuncticulatum* (Merr.) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 179 (1939). (Fig. 36c).

Widely distributed from Kedah to Singapore on the west of the Main Range, but nowhere frequent except in Singapore.  
*Distrib.*: Borneo.

A small tree, bark nearly entire or finely creviced or pimply, flaking in coarse pieces, not papery flaky, pinkish brown to vinaceous brown; inner bark pinkish, darkening on exposure. *Twigs* terete, slender, the younger ones green in life, older ones pale brown, bark smooth, drying pale brown and pustulate. *Leaves* dark green and shining above, very obscurely punctate, paler and dull below with darker gland dots, coriaceous, oblong or oblong lanceolate, apex acuminate, base cuneate, from c. 8-22 cm. long and 3-6.5 cm. broad, upper surface drying greenish or brownish, lower surface brown, pustulate; midrib impressed above, prominent and rounded below, smooth in life, pustulate when dry; *primary nerves* c. 10-15 pairs, c. 0.5-1 cm. apart, impressed above, elevate and conspicuous below, slightly ascending and curving gently up to a conspicuous shallowly looped intramarginal nerve 3-4 mm. from leaf margin, with a very faint loop very close to the margin; secondaries few, less distinct than primaries, reticulations invisible above, lax and faint below; petiole up to c. 1 cm. long.

*Panicles* terminal or from upper leaf axils, sometimes clustered, shortly peduncled or sessile, c. 3-5 cm. long (or rarely up to c. 11 cm.) with several pairs of spreading decussate branches, the lower ones c. 2 cm. long, the upper shorter, they and the rachis stout, green, obtusely quadrangular and grooved in life, 4-angled or compressed with brownish pustulate bark when dry; *flowers* fragrant, greenish yellow with green calyx lobes, white petals and white or yellow stamens, sessile in threes or fives at branchlet ends, buds cylindric oblong, truncate, 6-7 mm. long; *calyx* after anthesis narrowly campanulate, c. 6 mm. long, the tube minutely rugulose and glandular punctate, very slightly narrowed and rounded at base, without pseudostalk; lobes 4, subpersistent, incurved, very short and broad, subacute, c. 3 mm. across at base and 1 mm. tall; *petals* falling in a flattened calyptra, but not agglutinated, ovate orbicular, c. 3 mm. diam.; *stamens* numerous, filaments subulate, from less than 1 mm. to c. 5 mm. long, anthers oblong elliptic, c. 0.4-0.5 mm. long, connective gland rather large; *style* stouter than filaments, terete, narrowly conical, c. 3 mm. long; *ovary* 2-celled, multiovulate.

*Fruit* very pale green to white, shining, oblong globose, c. 1.3 cm. long, minutely rugulose pustulate when dry, apical umbilicus rather deep, c. 5–6 mm. diam., fringed by the 4 erect, somewhat enlarged calyx lobes and bearing the style base; pericarp c. 3 mm. thick at base of fruit, rather dry and pithy, white, rapidly turning purplish on exposure; seed 1, globose, c. 6 mm. diam., testa rather thick, pithy leathery; surface of cotyledons very pale yellow, glistening, somewhat rugose corrugate; cotyledons side by side, nearly equal, inner faces very finely gland dotted, with a median ridge and furrow, attached near their centres to the large, conspicuous, pink, angled, truncate hypocotyle which is grooved along one side and reaches the periphery of the seed. Germination epigeal.

I have examined duplicates of *Elmer 21223* (type of *E. perpuncticulata* Merr.) and *Elmer 21237* and can see no differences between them and our plant, except for the slightly blunter calyx lobes of Merrill's plant.

97. *Eugenia chloroleuca* King, Mat., F.M.P., No. 12, 113 (1901); Ridl., F.M.P., I, 744. (Fig. 36d).

PERAK: Larut, 2,000 feet, *Kunstler 1901* (syntype), 1,500–2,000 feet, *Kunstler 4951, 7807* (syntypes); Waterfall Hill, Taiping, *Wray 2917* (syntype); Taiping Hills, *Ridley 11920*; Tea Gardens, Larut, *Scortechini 45* (syntype).

JOHORE: Sungai Kayu Ara, Mawai-Jemaluang road, Corner s.n.

*Distrib*: Sumatra; Banguay Island (fide Ridley).

A *shrub* or small *tree*. *Twigs* slender, youngest 4-angled, older terete, bark polished, drying pale yellowish or brownish. *Leaves* coriaceous, oblanceolate, oblong lanceolate or elliptic lanceolate, apex acuminate, usually shortly and abruptly so, base long narrowed, from c. 6–17 cm. long and 2–5.5 cm. broad, upper surface shining, drying pale olivaceous or olivaceous brown, lower surface dull and paler, midrib impressed above, prominent and keeled below; *primary nerves* 12–16 pairs, very faint or invisible above, slightly raised below, very fine and faint, c. 0.5–1 cm. apart, spreading and curving slightly up to a very faint intra-marginal nerve 2–3 mm. from the thickened and recurved leaf margin, secondaries and reticulations usually invisible on both surfaces; petiole slender, up to c. 1.5 cm. long.

*Panicles* usually terminal, occasionally axillary, up to c. 3 cm. long, shortly peduncled or branched from base, trichotomous, branches and branchlets acutely 4-angled with pale, wrinkled or striate bark when dry, bracts and bracteoles persistent, ovate concave subacute, c. 1 mm. long; *flowers* in threes on stout 4-angled pedicels c. 2 mm. long, each flower subtended by two bracteoles; *calyx* c. 3 mm.

long, funnel shaped, more or less 4-angled, gradually tapered to base, without pseudostalk; lobes 4, persistent, broad and rounded, sparsely gland dotted, c. 1.5 mm. across and 0.75 mm. tall; *petals* calyptrate; *stamens* numerous, filaments stout, terete, glandular pustulate, up to c. 4 mm. long, anthers ovate oblong, c. 0.6 mm. long, connective gland inconspicuous; *style* slightly stouter than filaments, c. 2.5 mm. long, glandular pustulate, slightly broadened and truncate at apex; *ovary* 2-celled, apparently sometimes 4-5 celled at apex.

*Fruit* ellipsoid, c. 1 cm. long, rugulose when dry and pale coloured, apex with conspicuous wide calyx rim 3 mm. diam., edged with the enlarged incurved calyx lobes; seed 1, obovoid ellipsoid, cotyledons side by side, equal, commissure wavy, inner faces interlocking with triangular ridges and depressions, hypocotyle large, lying in a fold in the cotyledon face and reaching nearly to periphery of seed.

Allied to *E. fastigiata* as King points out, but differing in the leaves drying paler, with fewer, more widely spaced primary nerves; shorter stouter petioles; shorter inflorescences; and the fruit drying rugulose eglandular, not smooth and glandular.

98. *Eugenia fastigiata* (Bl.) Koorders and Valetton in Meded. Lands Plantent., XL, 104 (1900); Atlas Baumart. Java, III, fig. 479. *Calyptranthus fastigiata* Bl., Bijdr., 1090 (1825). *Calyptranthus floribunda* Bl., loc. cit., 1091. *Caryophyllus fastigiatus* Bl. in DC., Prodr., III, 262. *C. floribundus* Bl. in DC., loc. cit., 262. *Eugenia bracteolata* Wight, Ill., II, 15 (1850); Duthie in Hook. fil., F.B.I., II, 488; King, Mat. F.M.P., No. 12, 122; Gagnep. in Fl. Gen. Indo-Ch., II, 815; Ridl., F.M.P., I, 747; Craib, Fl. Siam. Enum., I, 633. *E. Elmeri* Merr. in Univ. Calif. Publ. Bot., XV, 218 (1919). *E. confertiflora* Koord. & Valet. in Meded. Lands Plantent., XL, 106 (1900); Atlas Baumart. Java, III, fig. 480. *Syzygium fastigiatum* (Bl.) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 152 (1939). (Fig. 36e).

Not uncommon in lowland forest and sometimes on low hills from Perlis and Kelantan to Johore.

*Distrib:* Tenasserim, Sumatra, Borneo, Java.

A tree up to c. 25 m. tall; bark smooth entire, slightly pustulate with lenticels, pinkish grey to pale pinkish white; inner bark pale brownish, green below surface. *Twigs* acutely or obtusely 4-angled, bark smooth, polished, drying pale brown or yellowish brown. *Leaves* coriaceous, oblanceolate or oblong obovate, apex obtuse or shortly and

bluntly acuminate or apiculate, base cuneate or long narrowed, up to c. 16 cm.  $\times$  6 cm., upper surface drying pale brown to almost black, shining, minutely punctate, lower surface dull and paler, often reddish brown, with scattered dark gland dots; midrib flat above or slightly raised and channelled, sometimes impressed towards apex of leaf, prominent and keeled below; *primary nerves* up to c. 30 pairs, 3-5 cm. apart, nearly horizontal or slightly ascending, running straight or slightly curving to an intramarginal nerve c. 1-2 mm. from the cartilaginous incurved leaf margin, usually very slightly raised and indistinct above, slightly raised below and very fine, usually distinct, the secondaries and reticulations less distinct and often hardly visible; petiole up to c. 1 cm. long.

*Panicles* terminal or occasionally from upper leaf axils, up to c. 15 cm. long, corymbose, rather densely flowered, pedunculate, branches slender and 4-angled and grooved like the peduncle, bracts and bracteoles persistent, ovate subacute, concave, gland dotted, c. 1 mm. long; *flowers* pale green or white, at apices of the many short 4-angled branchlets, on rather stout pedicels 1-2 mm. long, or occasionally sessile, each flower subtended by two bracteoles; *calyx* shortly and broadly funnel shaped, c. 3 mm. long and 2.5 mm. across mouth, tube 4-angled, tapered gradually to a broad base, without pseudostalk; lobes 4, persistent, broad and rounded, gland dotted, c. 1.5 mm. across and 0.5 mm. tall; *petals* falling in a thick hemispherical calyptra, pellucidly gland dotted, c. 2.5 mm. diam.; *stamens* numerous, filaments flattened and strap shaped below, subulate above, with scattered pustulate glands, up to c. 3 mm. long, anthers oblong ovate, c. 0.5 mm. long, the connective gland, which is often paired, conspicuous; *style* stout, c. 1.5 mm. long; *ovary* 2-celled.

*Fruit* (unripe) ellipsoid or oblong, c. 1 cm. long, closely glandular, apex convex bearing the 4 enlarged and incurved calyx lobes; seed 1, conforming to shape of fruit, cotyledons side by side, equal, inner faces conspicuously glandular, with triangular projections and depressions fitting into one another, the hypocotyle stout and angled, reaching the periphery of the seed.

Examination of authentic material of *E. fastigiata* from Buitenzorg, and of a duplicate type and other material of *E. Elmeri* Merr., as well as the type of *Calyptanthus floribunda* Bl., on which *E. confertiflora* Koord. & Valet. is based, leaves no doubt that they, and *E. bracteolata* Wight are all conspecific. These reductions have already been made by Merrill and Perry.

99. *Eugenia pallidula* Ridl., F.M.P., l. 748 (1922). (Fig. 37a, b).

PERAK: Pondok Tanjong Forest Reserve, Forest Dept. FMS 9717.

PAHANG: Rembau, Temerloh, Forest Dept. FMS 4783 (type); Sungai Semara, Pontian, Forest Dept. FMS 14976.

Distrib: Endemic.

A tree (fide Ridley). Twigs terete, slender, bark whitey brown, smooth. Leaves thinly coriaceous, elliptic or obovate, up to c. 9 cm. long and 4.5 cm. broad, apex rounded or very shortly and bluntly acuminate or very shortly acute, base long narrowed to petiole; petiole variable, usually c. 5 mm. long; midrib conspicuously channelled above, boldly raised below; primary nerves c. 11-14 pairs, usually slightly impressed above and very faint, raised below, slender but quite distinct, irregular in spacing but usually 3-6 mm. apart, meeting in a rather inconspicuous, shallowly looped, intramarginal nerve c. 1 mm. from leaf margin; secondaries and reticulations almost or quite invisible above, raised below and much less distinct than primaries; upper surface drying lead brown or dark brown, minutely punctate, lower surface pale, or at least paler than upper, sometimes very minutely gland dotted.

Inflorescences terminal or from upper leaf axils, more or less paniculate, very lax, up to c. 7 cm. long, with few and widely spaced spreading slender branchlets; flowers in threes at ends of the secondary branchlets, or on very short tertiary branchlets, occasionally in pairs or solitary, sessile; calyx tube c. 6-7 mm. long, cupshaped and abruptly narrowed into a slender pseudostalk c. 3 mm. long, longitudinally ridged when dry, mouth with 4 wide shallow thin subpersistent lobes; petals falling in a calyptra, only partially separable. gland dotted; stamens variable in length, reaching c. 6.5 mm. long, filaments slender, terete, anthers small, connective gland not conspicuous; style much stouter than filaments, tapering to apex, c. 7 mm. long. Fruit unknown.

100. *Eugenia nemestrina* Henderson in Gardens' Bulletin, Singapore, XI, 324, fig. 13 (1947).

SINGAPORE: McRitchie Reservoir, SFN 33590 (Corner); Selitar, near Nee Soon village, SFN 37396 (Corner); Mandai road, SFN 37252 (Corner).  
Known only from Singapore.

A tree 25-30 m. tall, slightly or prominently buttressed-fluted to c. 2 m. from ground; bark rufous brown, fissured or distinctly scaly flaky, inner bark deep purple. Twigs stout, terete, with smooth pale brown bark becoming scaly flaky and red brown. Leaves decussate, narrowly elliptic

to oblong elliptic, coriaceous, 6–11 cm.  $\times$  2–4.5 cm., dull green withering yellow, with upcurled margins and reflexed apex, drying pale brown to reddish brown above, dull pale brown to whitish brown below, apex acuminate and deflected sideways, base cuneate and long narrowed on to petiole; midrib sunk above, strongly raised and keeled below; *primary nerves* very fine, c. 20–25 pairs, raised on both surfaces, sometimes very obscure above, hardly or not distinguishable from secondaries below, reticulations slightly thickened and raised; intramarginal vein fine, c. 1 mm. from leaf margin; lower surface minutely black dotted; petiole 5–8 mm. long.

*Inflorescences* corymbose, terminal, not exceeding c. 8 cm. long and wide, much branched; *flowers* usually in threes or sometimes solitary at ends of branchlets, sessile or sometimes on pedicels 2–4 mm. long or the outer two flowers of the triads shortly pedicelled and the centre flower sessile; buds c. 1.3–1.4 cm. long including pseudostalk; *calyx* pale green, gland dotted, tube cyathiform, c. 6 mm. across mouth, tapering into a ridged pseudostalk c. 4–5 mm. long, mouth truncate or wavy or occasionally with exceedingly obscure teeth; after anthesis the calyx funnel shaped, c. 7 mm. across mouth; *petals* calyptrate, white; *stamens* numerous, filaments white with green bases, 1–2.5 cm. long, anthers c. 0.5 mm. long and 0.4 mm. broad, connective gland distinct; *style* a little shorter than stamens; *ovary* 2-celled, multiovulate.

*Fruit* more or less globular, c. 1.5 cm. diam., smooth, crowned by the very conspicuous undulating calyx rim c. 2 mm. high; pericarp 2–3 mm. thick; cotyledons nearly equal, inner faces nearly plane, attached to the hypocotyle by short broad stalks.

This species does not closely resemble any other, and is distinguished by the rather narrow long acuminate leaves and the copious corymbose inflorescences with rather large, long, narrow flowers and the almost truncate calyx mouth.

101. *Eugenia taipingensis* Henderson in Gardens' Bulletin, Singapore, XI. 327, fig. 14 (1947). (Fig. 37c).

PERAK: Taiping, plains, Wray 2703, within 100 feet, Kunstler 8379.

Known only from these collections.

A low tree with spreading branches, 4.5–6 m. tall, stem 8–13 cm. diam. *Twigs* smooth, terete, bark brown to pale whitey grey or brownish white. *Leaves* coriaceous, broadly ovate or elliptic, sometimes tending to be obovate, up to c. 6.5 cm.  $\times$  3.5 cm., apex abruptly acuminate, acumen c. 1 cm. long, base abruptly narrowed and decurrent on petiole, drying dull brown or blackish brown and minutely punctate

above, usually reddish brown below, very minutely black gland dotted or not; midrib sunk above, raised below and slightly pustulate near base; *primary nerves* about 10 pairs, very slender and almost indistinguishable from secondaries and reticulations, intramarginal nerve slender c. 1 mm. from leaf margin; petiole 2-5 mm. long.

*Panicles* terminal, up to c. 6 cm. long and 4 cm. across, branchlets spreading, slender, angled, with brownish or greyish striate bark; *flowers* crowded at ends of ultimate branchlets; *calyx* tube in bud c. 4 mm. long and 2-2.5 mm. across mouth, narrowly campanulate, quickly contracted some way below mouth, then tapering gradually into a pseudostalk c. 2 mm. long, mouth truncate or wavy or with very obscure shallow lobes; *petals* probably calyptrate, more or less agglutinated, conspicuously gland dotted; *stamens* numerous, filaments slender, up to c. 6 mm. long, anthers c. 0.4-0.5 mm. long, connective gland conspicuous; *style* much stouter than filaments, c. 5 mm. long. *Fruit* unknown.

This species was included under *E. oleina* by King and presumably also by Ridley, but although it has a superficial resemblance to that species it is very distinct in its broader and more acuminate leaves with the nervation raised above, and in its truncate calyx mouth.

102. *Eugenia nigricans* King, Mat. F.M.P., No. 12, 114 (1901); Ridl., F.M.P., I, 751. *Syzygium nigricans* (King) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 194 (1939). (Fig. 37d).

TRENGGANU: Gunong Padang, 4,000 feet, SFN 33903 (*Moysey & Kiah*), specimens in young fruit with leaves larger and thicker than the type, and referred here with some doubt. They may represent a mountain variety.

KEMAMAN: Bukit Kajang, Corner s.n., leaf specimens with leaves larger than the type, and referred here with a little doubt.

PENANG: sine loc., Curtis 976; between Balik Pulau and Pulau Betong, Curtis 937 in part.

PERAK: Waterfall hill, Taiping, 1,000 feet, Wray 2221 (type collection); sine loc., Scortechini 203.

MALACCA: sine loc., Griffith s.n.

NEGRI SEMBILAN: Bukit Tangga, SFN 11828 (*Nur*).

PAHANG: Sungai Endau, Forest Dept. FMS 6766; Kuantan, Forest Dept. FMS 8128.

JOHORE: Pinerong, Cantley s.n.; Jason Bay, SFN 28497, 28522 (*Corner*).

SINGAPORE: Bukit Timah, SFN 34988 (*Corner*), SFN 36128, 36531, 37015 (*Ngadiman*).

*Distrib.* Borneo.

A tall massive tree, trunk slightly fluted at base or with narrow low buttresses, sometimes stilt rooted; bark smooth, entire or slightly longitudinally fissured and flaky,

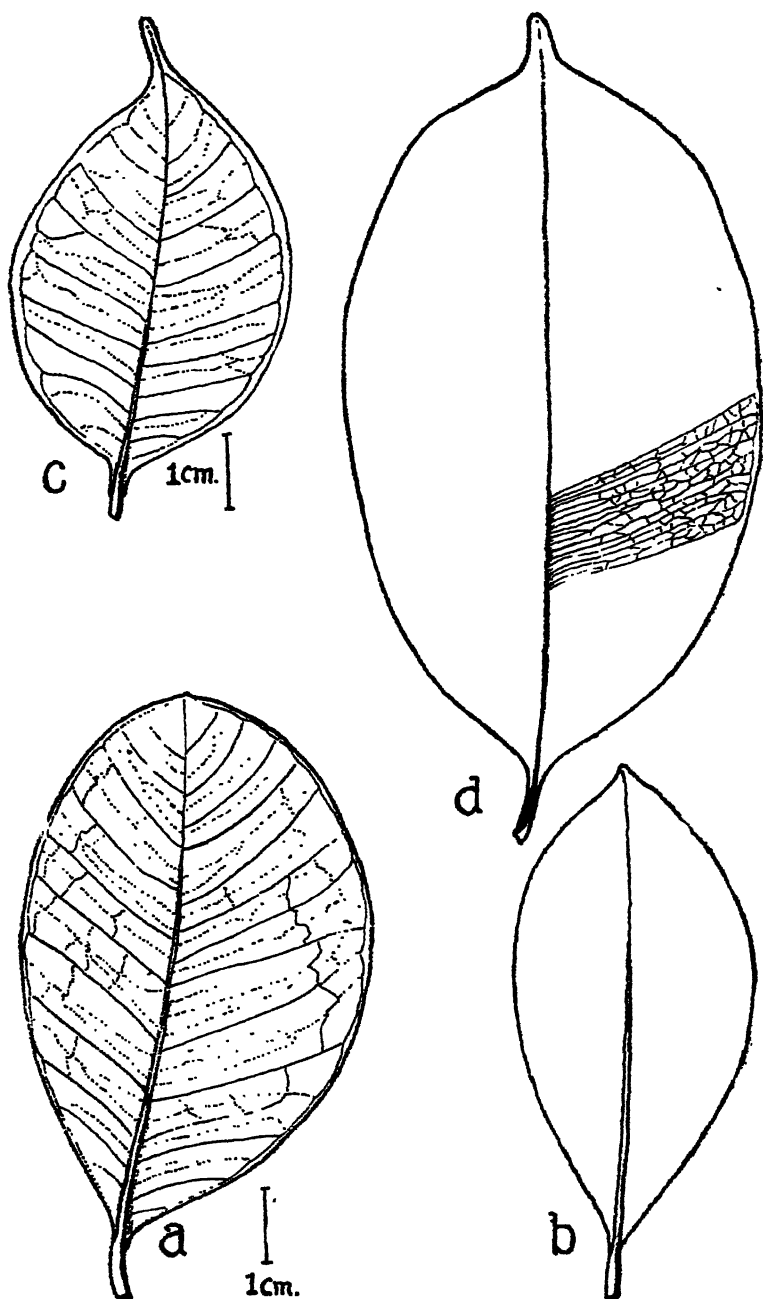


Fig. 37. a, b, *E. pallidula*; c, *E. taipingensis*; d, *E. nigricans*, upper surface.

not papery or rugose, scaling in small thin irregular pieces, leaving areas of entire more or less pustulate bark, pale grey or pinkish grey to pale rufous fawn; inner bark reddish pink, pinkish brown or deep purple brown, thick, more or less fibrous, with sticky pale sap, sapwood thin, pale, heartwood red brown. *Twigs* slender, terete, when dry with brown smooth or flaky bark. *Leaves* coriaceous, narrowly elliptic to elliptic oblong or oblong, apex rather shortly and abruptly acuminate, base cuneate, from c. 6–12 cm. long and 3.5–5.5 cm. broad, upper surface more or less shining when dry and dark olivaceous or brownish, minutely punctate or pustulate, lower surface dull, tinged reddish or brownish, sometimes minutely pustulate; midrib impressed above, elevate below; *primary nerves* very numerous and close together, running nearly straight to an intramarginal nerve close to leaf margin, raised and fine on both surfaces, but more distinct above, joined by close reticulations which are almost as distinct as primaries above but faint below; petiole up to c. 1 cm. long.

*Panicles* terminal and axillary, not more than about half length of leaves, rather densely flowered, branches and branchlets slender, 4-angled or compressed, bracts and bracteoles minute, broad, subpersistent; *flowers* white, sessile in threes or clusters at branchlet ends, buds clavate c. 5 mm. long; *calyx* funnel shaped or narrowly campanulate, slightly ridged, c. 4–4.5 mm. long, c. 2.5 mm. across mouth, narrowed into a rather slender pseudostalk c. 2 mm. long; mouth with 5 very shallow very obscure deciduous lobes; *petals* calyptrate, the outer one partially free; *stamens* numerous, filaments slender, up to c. 6–7 mm. long, anthers ovate or ovate oblong, c. 0.4 mm. long, connective gland conspicuous; *style* stouter than filaments, c. 3.5 mm. long; *ovary* 2-celled.

Characterised by the fine raised close reticulation on the upper surface of the leaves.

103. *Eugenia cerasiformis* (Bl.) DC., Prodr., III, 274 (1828). *Myrtus cerasiformis* Bl., Bijdr., 1088 (1826). *Syzygium cerasiforme* (Bl.) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 187 (1939). *Syzygium javanicum* Miq., Fl. Ind. Bat., I, i, 461 (1855); Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 188, excl. syn. *S. euneuron* Miq. *Syzygium racemosum* (Bl.) DC., loc. cit., 261; Merr. & Perry, loc. cit., 189. *Eugenia expansa* Duthie in Hook. fil., F.B.I., II, 491 (1878); King, Mat. F.M.P., No. 12, 113, pro parte; Ridl., F.M.P., I, 745; non *E. expansa* Mart. (1837). *E. jamboloides* Koord. & Valet. in Meded. Lands Plantent., XL, 136 (1900);

Atlas Baumart. Java, III, fig. 497; Backer, Schoolflora voor Java. 512 (1911). ? *E. laxiflora* Koord. & Valet. in Meded. Lands Plantent., XL, 139 (1900); Atlas Baumart. Java, III, figs. 498, 499. *E. javensis*. Koord. & Valet. in Meded. Lands Plantent., XL, 141 (1900); Atlas Baumart. Java, III, fig. 451. *E. Zippeliana* Koord. & Valet. in Meded. Lands Plantent., XL, 142 (1900); Atlas Baumart. Java, III, fig. 500. *E. Robinsoniana* Ridl. in Journ. F.M.S. Mus., IV, 13 (1909); F.M.P., I, 734. *E. Evansii* Ridl. in Journ. F.M.S. Mus., X, 134 (1920); F.M.P., I, 747. *E. bunneoramea* Merr. in Univ. Calif. Publ. Bot., XV, 217 (1929). *E. euneura* Craib. Fl. Siam. Enum., I, 640 (1931) non *Syzygium euneuron* Miq. (Fig. 38a).

Not rare in lowland forest from Langkawi to Malacca and Pahang. A collection of *Cantley's* from Singapore appears to be wrongly localised.

*Distrib.*: Siam, Sumatra, Borneo, Java.

*A tree.* *Twigs* slender, terete, bark drying brownish or greyish, smooth. *Leaves* coriaceous, oblong elliptic or oblong lanceolate or oblong or elliptic, apex acute or shortly acuminate, base cuneate, from c. 8 cm.  $\times$  3 cm. to 18 cm.  $\times$  7 cm., both surfaces brown or reddish brown when dry, the upper sometimes blackish and minutely punctate, the lower paler; midrib impressed above, elevate below; *primary nerves* 15–25 pairs, 4–10 mm. apart, spreading and curving up to an intramarginal nerve 1–3 mm. from leaf margin, slightly raised and indistinct above, raised and slender below, usually distinct, secondaries and reticulations less distinct than primaries; petiole usually not more than c. 5 mm. long, occasionally c. 1 cm.

*Panicles* terminal and axillary, often clustered, variable in length from c. 3 cm. to c. 7 cm., the longer ones with a few slender branches, the shorter ones sometimes rather densely flowered; *flowers* white, sessile, in threes or groups of several at branchlet ends, bracts and bracteoles minute, triangular acute, subpersistent; buds clavate; *calyx* funnel shaped, c. 6 mm. long and 3 mm. across mouth, finely rugulose gland dotted, rather gradually contracted into a pseudostalk c. 2–3 mm. long, mouth truncate or undulate with a thin margin; *petals* falling in a gland dotted calyptra c. 3 mm. diam.; *stamens* numerous, filaments slender, subulate, from 2–6 mm. long, anthers ovate oblong, 0.5–0.7 mm. long, connective gland conspicuous; *style* much stouter than filaments, c. 6 mm. long; *ovary* 2-celled.

*Fruit* depressed globose or transversely oblong globose, c. 2 cm. across, finely rugulose papillate when dry, apical umbilicus very shallow, c. 4 mm. diam., bearing the very short undulate calyx rim; pericarp thin; cotyledons side by

side, nearly equal, testa rather thick, adhering to the rugose cotyledon surfaces; inner faces somewhat concave, attached to hypocotyle near their centres by short broad stalks.

When Craib made a new combination for this plant, it appears probable that he followed King's reduction of *Syzygium euneuron* Miq. without seeing Miquel's plant. I have examined a duplicate of Miquel's type from Leiden and consider it to be very distinct from our plant in the distinctly 4-angled and very narrowly winged uppermost twigs; in the impressed primary nerves above, which are much more prominent below than in *E. cerasiformis*, and are more widely spaced and more distinct from the secondaries; in the intramarginal nerve further from the leaf margin; and in the more caudate acuminate leaf apex.

*Myrtus cerasiformis* Bl. was reduced (as *Jambosa cerasiformis* Hassk.) to *E. lineata* Duthie (*E. longiflora* F. Vill.) by Koorders & Valetton, but an examination of the type of Blume's plant, which is in fruit, shows very clearly that this reduction is erroneous. Although Blume's specimen has no flowers it corresponds so closely in all other points with our plant that I have no doubt that it is the same.

I have been able to examine long series of specimens of *E. jamboloides* K. & V., *E. javensis* K. & V., and *E. Zippeliana* K. & V., and have come to the conclusion that they vary from *E. cerasiformis* only in such relatively minor points as the colour of the bark of the twigs and the length and modes of branching of the inflorescence.

104. *Eugenia conglomerata* Duthie in Hook. fil., F.B.I., II, 497, (1878); King, Mat. F.M.P., No. 12, 101; Ridl., F.M.P., I, 742. (Fig. 38b).

SELANGOR: Sungai Pelek, Sepang, Denny 56, 61; Serdang Experimental Plantation, cultivated, Corner s.n.

MALACCA: sine loc., Maingay K.D. 745 (type collection), Alms s.n., 422; Gunong Ledang, Ridley s.n.

SINGAPORE: Botanic Gardens, Ridley 5073, 10836, Gardens No. M 1502 (Nur); sine loc., Cantley s.n.

Distrib: Endemic.

Tall massive tree with steep rounded narrow buttresses; bark slightly fissured, somewhat flaky and scaling in small rectangular pieces, reddish brown to warm brown; inner bark pinkish brown or fawn pink, rather thick, more or less fibrous; wood pale. Youngest twigs more or less 4-angled with dark brown bark when dry, older twigs terete with greyish or brownish smooth. Leaves coriaceous, oblanceolate to narrowly obovate, apex subacute or blunt, base long narrowed, from c. 5 cm.  $\times$  2 cm. to 10 cm.  $\times$  5.5 cm., but usually c. 7-8 cm.  $\times$  3-3.5 cm., upper surface

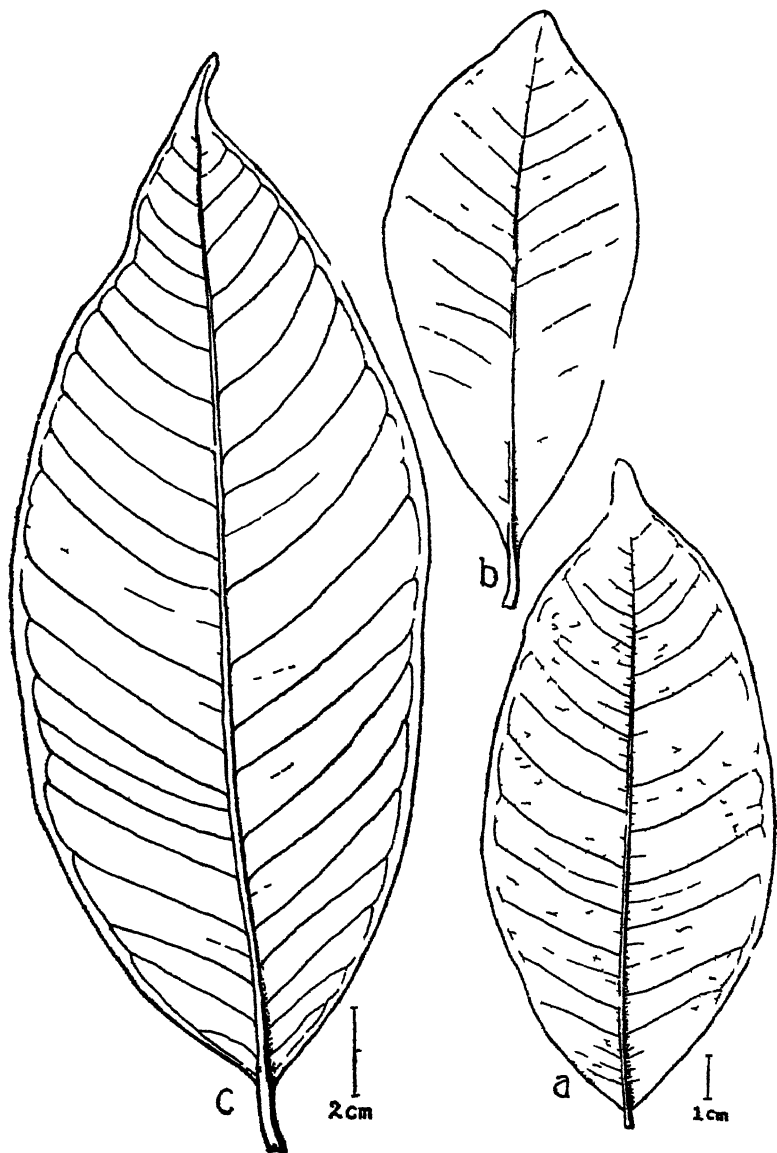


Fig 38 a, *E cerasiformis*, b, *E. conglomerata*; c, *E leptostemon*.

shining, drying blackish brown, finely rugose, lower surface dull, liver brown, closely and minutely glandular pustulate; midrib slightly elevate or flat above, elevate below and keeled or longitudinally wrinkled; *primary nerves* c. 8–12 pairs, spreading and curving up to a very obscure intramarginal nerve 2–3 mm. from the recurved leaf margin, raised on both surfaces, usually rather thick and distinct above, very fine and faint or almost invisible below, secondaries and reticulations almost or quite invisible; petiole up to c. 1 cm. long, the leaf blade sometimes decurrent upon it.

*Inflorescences* of short fascicled spikes from small tubercles on the older twigs below the leaves, up to c. 1 cm. long, the rachis 4-angled, the *flowers* crowded at the apices of the spikes with one or two lower down, sessile; calyx red to purple, petals and stamens white; bracts and bracteoles persistent, triangular subacute, less than 0.5 mm. long; buds broadly obconic, c. 2.5–3 mm. long; *calyx* broadly funnel shaped or somewhat campanulate, c. 2–2.5 mm. long, and as much across mouth; lobes 4, persistent, broad, rounded, or subacute, c. 1.5 mm. across and 1 mm. tall; *petals* 4, free, broadly ovate rounded, or orbicular, c. 1.6–2 mm. across and 1–1.5 mm. tall, thin, sparsely gland dotted; *stamens* numerous, filaments subulate, from almost none to c. 2.5 mm. long, anthers oblong, 0.3–0.4 mm. long, connective gland small; *style* stout, 4-angled, less than 1 mm. long; *ovary* 2-celled, with several ovules in each cell.

*Fruit* depressed globose, sometimes more or less globose, up to c. 1 cm. long and 1.25 cm. across, shining dark purplish red when ripe, apical calyx rim not prominent, the umbilicus shallow, c. 3 mm. diam., with the 4 fleshy incurved calyx lobes and remains of style and stamens; pericarp juicy pulpy, c. 3 mm. thick, deep red pink, slightly acid and astringent, stripping easily from the seed and leaving testa on cotyledons; seed 1, much depressed globose, c. 5 mm. high and 7.5 mm. across, testa very thin, brown, papery fibrous; cotyledons side by side, stalked, pale green, finely gland dotted, inner faces deeply folded to accommodate the large terete truncate pale green gland dotted hypocotyle which reaches outer surface of cotyledons, point of attachment of cotyledons nearly central, with very broad short stalks, plumule hidden under fold; germination epigeal. When the cotyledons begin to move apart on germination, the broad stalks curving round to meet the hypocotyle are clearly seen and the structure is like that of *E. malaccensis* in miniature.

A distinct species in its large size, the rather small oblanceolate blunt faintly nerved leaves and the very short crowded spikes of small flowers from below the leaves.

**E. conglomerata** Duthie var. **paniculata** var. nov.

A *typa inflorescentiis paniculatis ad 4 cm. longis differt.*

JOHORE: Sungai Kayu Ara, Mawai-Jemaluang road, on hilllock in *Dryobalanops* forest, SFN 29368 (Corner). TYPE collection, holotype in Herb. Singapore.

The inflorescences of the typical form are, at their longest, in fruit, c. 12 cm. and spicate. The inflorescences of the variety have one or two pairs of branchlets up to c. 15 cm. long, those and the peduncle stout, ridged and angled. Only one collection of the variety is known, a fallen branch from a tree which the collector notes as evidently fairly big.

195. *Eugenia leptostemon* (Korth.) Miq., Fl. Ind. Bat., I, i, 442 (1858). *Jambosa leptostemon* Korth., Nederl. Kruidk. Arch., I, 201 (1847). *Syzygium leptostemon* (Korth.) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 156 (1939). *Eugenia urceolata* King, Mat. F.M.P., No. 12, 101 (1901); Ridl., F.M.P., I, 742; non *Jambosa urceolata* Korth., vel *Eugenia urceolata* Cordem. (1895). *Eugenia rotata* Craib, Fl. Siam. Enum., I, 660 (1931). *E. subracemosa* Merr. in Journ. Roy. As. Soc. Str. Br., LXXIX, 23 (1918). (Fig. 38c).

Common in lowland forest from Kedah to Singapore, occasionally in hill forest. Not recorded from Penang.

*Distrib*: Siam, Bangka, Borneo.

A small slender *tree*, or up to c. 18 m. tall, trunk cylindric at base or slightly buttressed; bark smooth, entire, slightly pustulate, light grey, slightly pinkish fawn; inner bark pinkish fawn. Youngest *twigs* obtusely 4-angled and grooved, drying smooth and reddish brown, older twigs terete or slightly angled, bark pale grey or pale brown, wrinkled or somewhat flaky. *Leaves* coriaceous, elliptic, elliptic oblong or obovate elliptic, apex shortly and bluntly acuminate, base cuneate, from c. 9–24 cm. long and 3.5–12 cm. broad, usually c. 12–18 cm.  $\times$  6–9 cm., upper surface drying dark brown to blackish brown, shining, minutely punctate, lower surface reddish brown, dull, with minute raised dark gland dots; midrib broad and flat above or slightly raised and channelled, elevate below and keeled; *primary nerves* 12–20 pairs, 1–2 cm. apart, obliquely ascending to a prominent shallowly looped intramarginal nerve 3–6 mm. from leaf margin, finely channelled above, elevate and very distinct below, sometimes broad and dark coloured, the few lax reticulations faint; petiole up to c. 1 cm. long, usually above 5 mm.

*Inflorescences* from small tubercles on the twigs below the leaves, very occasionally axillary or terminal, solitary or several together, subracemose, from c. 1.5–5 cm. long, or fascicled, or occasionally paniculate, the rachis, and branches when present, slender; *flowers* white, sessile, usually 5 at the distal end of the rachis, with 1 or 2 pairs lower down, or in groups of three at ends of branches; *calyx* 6–8 mm. long, and about 5–6 mm. across mouth, sub-turbinate, rather abruptly contracted below lobes and narrowed to a slender pseudostalk; lobes 4, persistent, gland dotted, slightly unequal, broadly ovate rounded, the two outer rather thick, c. 4 mm. across and 2 mm. tall, the inner with thin margins, c. 3 mm. tall; the calyx eventually opening out into a flat disc; *petals* 4, free, spreading, orbicular, gland dotted, 5–6 mm. diam.; *stamens* numerous, filaments slender, subulate, reaching nearly 1 cm. long, anthers ovate orbicular, 0.2–0.3 mm. long; *style* much stouter than filaments, subulate, c. 7 mm. long; *ovary* 2-celled.

*Fruit* ovoid globose, c. 1.5 cm. long, vertically ridged or corrugate, apical umbilicus c. 4 mm. diam., fringed by the very short calyx rim and the 4 hardly enlarged calyx lobes; pericarp thin and leathery (in dried fruits); seed 1, oblong globose, c. 1.2 cm. long, testa leathery, adhering closely to the rugose surface of the cotyledons; cotyledons nearly equal, side by side, inner faces gland dotted, excavate, attached by very broad, very short stalks to the large gland dotted hypocotyle which lies in a fold of the cotyledon faces and reaches the periphery of the seed.

This species is distinguished by the spaced and distinct obliquely ascending primary nerves of the leaf, the short subracemose inflorescences usually from below the leaves and the calyx opening out after anthesis into an almost flat disc.

106. *Eugenia pseudosubtilis* King, Mat. F.M.P., No. 12, 123 (1901), incl. var. *platyphylla* et var. *subacuminata* King; Ridl., F.M.P., I, 746; Craib, Fl. Siam. Enum., I, 657; Corner, Wayside Trees of Malaya, p. 502, fig. 168. *E. cinerea* Ridl., F.M.P., I, 744, quoad specimina malayana, non Kurz ? *Syzygium minutiflorum* Miq., Fl. Ind. Bat., Suppl. I, 311 (1860). (Fig. 39c).

Common in the lowlands, especially in the north of Malaya, in villages and ricefields. Not uncommon in the freshwater swamp forest of S.E. Johore, and in Singapore.

*Distrib*: Siam, Sumatra, ? Borneo, ? Indo-China.

A tree reaching c. 25 m. tall, trunk cylindric or slightly fluted and buttressed at base; bark of older trees deeply cracked or almost fissured vertically, with finer crevices

vertically and horizontally, sometimes scaling slightly, surface between cracks smooth or rugulose, pale whitey grey or greyish buff; of younger trees smooth and entire, or finely creviced longitudinally, sometimes slightly pimply with inconspicuous lenticels, scaling in rather thick pieces or not, whitey grey or light pinkish grey; inner bark pinkish brown; wood pale, flesh colour or yellowish, turning fuliginous on exposure. *Twigs* terete, bark smooth, drying whitey grey or yellowish grey, the youngest parts sometimes pale brown. *Leaves* thickly coriaceous, oblong elliptic or narrowly elliptic, occasionally somewhat obovate, apex blunt or subacute or shortly and broadly apiculate, base cuneate, from c. 5–16 cm. long and 2.5–7 cm. broad, usually c. 7–11 cm.  $\times$  4–5 cm., upper surface dull, drying pale brown to blackish brown, closely and minutely punctate, lower surface paler; midrib impressed above, prominent below and often pustulate towards the petiole; *primary nerves* 6–10 pairs, usually c. 1 cm. apart, impressed above and usually faint, more or less raised below and fine, usually distinct, curving up to a faint or obscure intramarginal nerve 2–4 mm. from leaf margin; *secondaries* and *reticulations* usually very faint; petiole up to c. 1.5 cm. long, the leaf blade sometimes narrowly decurrent upon it.

*Panicles* terminal and axillary, occasionally from twigs below the leaves, often clustered, usually as long as or shorter than the leaves, occasionally overtopping them, on peduncles shorter than the leaves, branches few, distant, divaricate, trichotomous, slender and 4-angled or compressed; *flowers* with reddish calyx, yellowish stamens and petals, sessile in threes at ends of the short ultimate branchlets; bracts and bracteoles short and broad, caducous or subsistent; *calyx* after anthesis funnel shaped or slightly campanulate, finally somewhat urn shaped, c. 3 mm. long, c. 2.5 mm. across mouth, tube finely gland dotted, slightly narrowed to base, mouth with 4 broad very shallow rounded rather obscure lobes; *petals* calyptrate; *stamens* numerous, filaments subulate, glandular, up to c. 2 mm. long, anthers oblong or ovate oblong, c. 0.5–0.7 mm. long, connective gland conspicuous; *style* stouter than filaments, c. 1 mm. long; *ovary* 2-celled, multiovulate.

*Fruit* depressed oblong globose, pink to almost black, c. 1.5 cm. diam., 1.2 cm. high, apex deeply and narrowly excavate with minute remains of calyx rim; pericarp pulpy fleshy, with fibrous strands, 3–4 mm. thick; seed 1, inner cotyledon faces gland dotted, ridged, attached near their centres by broad short stalks to the rather large hypocotyle.

The seeds are nearly always infected with the larvae of a species of phytophagous Braconidae (fide H. M.

Pendlebury). The only uninfected seeds so far found out of many hundreds examined are those of Ridley's Perlis collection.

It seems probable that the correct name for this plant is *Eugenia borneensis* Miq., Anal. Bot. Ind., I, 24, t. 7 (1850). Our material agrees fairly well with Miquel's description and plate, but certain differences as figured by Miquel, notably the free, not calyptrate petals and the more abruptly narrowed calyx tube, along with the fact that no material of Miquel's species has been available for comparison, make it advisable that the formal reduction should not be made until Miquel's type can be compared with our plant. An argument in favour of reduction is that Merrill and Perry (Mem. Amer. Acad. Arts & Sci., XVIII, 3, 190 (1939)) reduce *E. microcalyx* Duthie to *E. borneensis* Miq. apparently on the basis of *Kunstler 10733* and *Kunstler 10735*, both named *E. microcalyx* by King, and on a later collection from the Malay Peninsula, the details of which are not given. *Kunstler 10735* is *E. pseudosubtilis*. *Kunstler 10733* I have not seen, but as noted below, King's determinations of *E. pseudosubtilis* and *E. microcalyx* were not always reliable. Typical *E. microcalyx* could hardly be reconciled with Miquel's description and figure of *E. borneensis*.

Ridley refers part of *E. pseudosubtilis* to *E. cinerea* Kurz. Kurz included Wall. Cat. 3576 in his species, but this is undoubtedly *E. pseudosubtilis* and not the Burmese plant. Craib, Fl. Siam. Enum., I, 634, selects the Burmese plant as the type of *E. cinerea* in spite of the fact that Kurz used Wallich's specific name and I have followed this procedure here. Merrill and Perry in Journ. Arn. Arb. XIX, 106, accept Ridley's disposition of *E. pseudosubtilis* var. *platyphylla*, but their remarks make me suspect that the Indo-Chinese plants which they refer to *E. cinerea* are really *E. pseudosubtilis*.

*E. pseudosubtilis* is closely allied to *E. microcalyx*, and although the typical forms of each are easily separable even on foliage characters alone, considerable difficulty may be found in placing correctly specimens which appear to combine the characters of *E. microcalyx* var. *irregularis* and of the broader leaved more strongly nerved forms of *E. pseudosubtilis*. Judging from the annotations on sheets in Herb. Calcutta and Herb. Singapore, there was considerable confusion in King's mind over the identity of the two species, "microcalyx" having been substituted, in my opinion wrongly, for "pseudosubtilis" many times, even *Kunstler 6946* and *Ridley 4990*, syntypes of *E. pseudosubtilis*, being treated in this manner.

The main distinguishing points between the two species are—(1) the very pale bark of the twigs in *E. pseudosubtilis* compared with the dark bark of *E. microcalyx* (this character breaks down in *E. pseudosubtilis* var. *montana*); (2) the more coriaceous texture of the leaves in *E. pseudosubtilis*; (3) the generally longer inflorescences on longer peduncles in *E. microcalyx*; (4) the persistent bracteoles in *E. microcalyx*; (5) the smaller flowers of *E. microcalyx*; (6) the broad blunt calyx lobes of *E. pseudosubtilis* compared with the very small narrow acute lobes in *E. microcalyx*; (7) the dark red or almost black ripe fruit of *E. pseudosubtilis* compared with the white tinged pink fruit of *E. microcalyx*.

*E. pseudosubtilis* King, var. *montana* var. nov.

A *typa* foliis valde coriaceis plus minusve ovatis (ad 8.5 cm. longis et 5 cm. latis), nervis primariis subtus plus minusve prominentibus, apice obtuse acuminatis, cortice ramulorum fusco differt.

PAHANG: "Telom", Ridley 13901 (inflorescences more copious and longer than in other specimens quoted here); 47th mile, Telom road, SFN 31258 (*Holtum*), TYPE collection, holotype in Herb. Singapore; Cameron Highlands, 3,700 feet, SFN 32734 (*Nur*); Fraser Hill, Forest Dept. FMS 7796.

This group has been kept separate because it may be found to represent a distinct species closely allied to *E. pseudosubtilis* and *E. microcalyx*.

King's varieties *platyphylla* and *subacuminata* are not worth keeping up.

107. *Eugenia microcalyx* Duthie in Hook. fil., F.B.I., II, 493 (1878); King, Mat. F.M.P., No. 12, 124, incl. var. *obovata* pro parte; Ridl., F.M.P., I, 745. (Fig. 39a).

An endemic species not uncommon in lowland forest and secondary growth from Penang to Singapore on the west side of the Main Range.

A tree up to c. 15–16 m. tall. Youngest twigs somewhat 4-angled with smooth bark drying dark brown, older twigs terete with paler brown bark. Leaves coriaceous, lanceolate or oblong lanceolate to oblanceolate or obovate, apex subacuminate or blunt, long narrowed to base, from c. 5 cm. × 2 cm. up to c. 14 cm. × 7 cm., usually about 8 cm. × 3 cm., upper surface drying blackish brown to black, slightly polished, minutely and closely punctate, often appearing minutely rugulose, lower surface red brown with minute concolorous or darker pustulations; midrib impressed above, elevate below and rather obscurely pustulate; primary nerves about 10 pairs, more or less impressed and

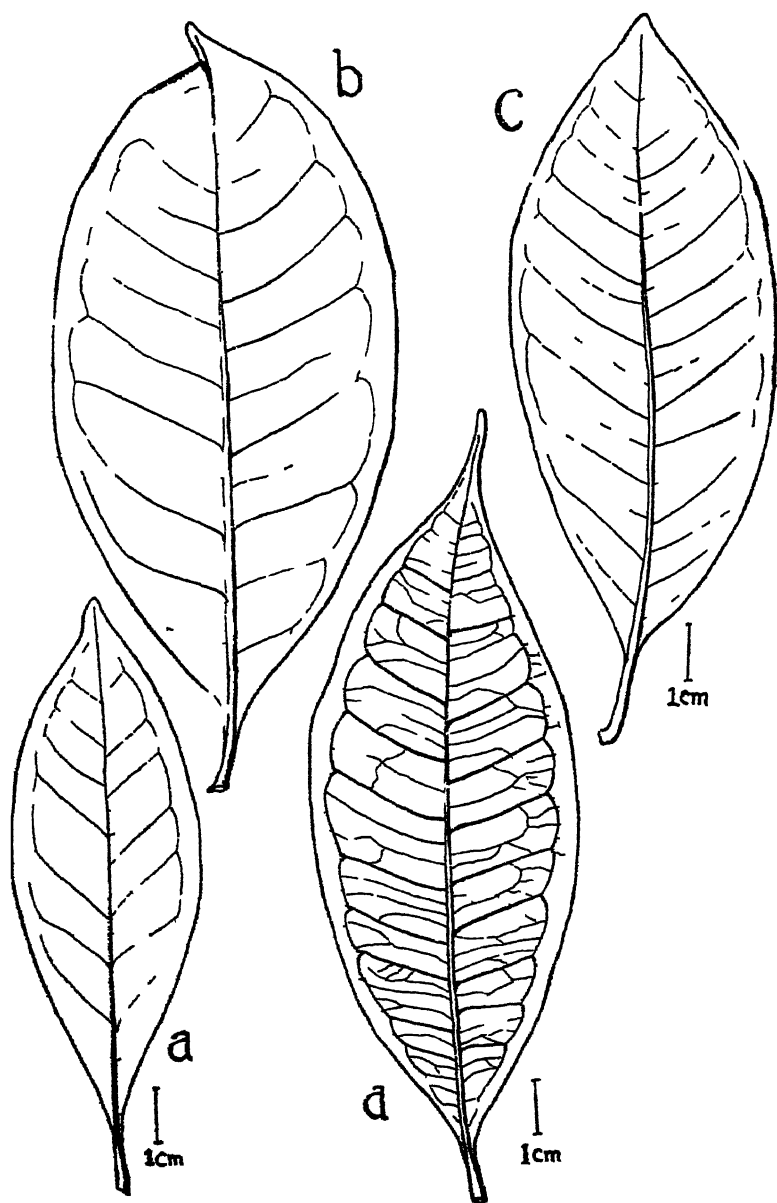


Fig 39 a, *E. microcalyx*; b, *E. microcalyx* var *irregularis*;  
c *E. pseudosubtilis*; d, *E. Kunstleri*.

faint above, raised and fine below, distinct or indistinct, slightly ascending and running nearly straight to a distinct or indistinct intramarginal nerve 2-4 mm. from the strongly and irregularly recurved leaf margin; petiole 0.5-1 cm. long, the leaf blade more or less decurrent upon it.

*Panicles* terminal and axillary, sometimes clustered, usually exceeding the leaves, on peduncles as long as or longer than the leaves, sometimes sessile, reaching 12-14 cm. long, branches and branchlets rather lax, spreading, slender, angled or compressed, with brownish and obscurely pustulate striate bark; bracts and bracteoles minute, triangular acute, persistent; *flowers* yellowish white in threes or clusters at branchlet ends, sessile; *calyx* finely glandular pustulate, subcylindrical, a little over 2 mm. long and c. 1.2 mm. across mouth, very slightly tapered at base; mouth with 4 distant very short obscure triangular acute persistent lobes; *petals* falling in a calyptra, but not or very slightly agglutinated, orbicular, sparsely pellucidly gland dotted, c. 1.2-1.4 mm. diam.; *stamens* less than 20, filaments rather stout, flattened below, subulate above, up to c. 1 mm. long, anthers ovate c. 0.2-0.3 mm. long, connective gland inconspicuous; *style* narrowly conical c. 0.5 mm. long; *ovary* 2-celled.

*Fruit* waxy white tinged with red, finely rugose when dry, globose or depressed globose, c. 4-5 mm. diam., apical umbilicus very shallow, hardly excavate, c. 2 mm. diam., fringed by the slightly enlarged calyx lobes; seed 1, more or less globose, cotyledons nearly equal, side by side, inner faces gland dotted, nearly plane or somewhat concave, attached to hypocotyle near periphery, the plumule and radicle sunk in a fold of one cotyledon face.

See notes on *E. pseudosubtilis*.

***E. microcalyx* Duthie var. *irregularis* (Craib) var. nov.**  
(Fig. 39b).

*Eugenia irregularis* Craib in Kew. Bull. 167 (1930); Fl. Siam. Enum., I, 646. *E. microcalyx* Corner, Wayside Trees of Malaya, p. 500. *Syzygium irregulare* (Craib) Merr. & Perry in Journ. Arn. Arb., XIX, 107 (1938).

NEGRI SEMBILAN: Seremban, Corner s.n.

SINGAPORE: Bukit Mandai, Ridley 10410; Economic Gardens, Ridley 12482; Reservoir Jungle, SFN 29495, 30995, 30996 (Corner); Botanic Gardens, SFN 36530 (Kiah).

*Distrib.*: Siam, Indo-China.

A small tree; bark more or less smooth, finely shortly irregularly creviced or occasionally with slight fissures, scaling in small irregular pieces, pale pinkish grey to whitish grey, a very thin inconspicuous green layer

immediately below surface; inner bark thick and fibrous with copious watery sap, pale pinkish buff, darkening rapidly on exposure; wood almost white. Young *twigs* terete, rather stout, green in life, drying reddish brown. *Leaves* elliptic or oblong elliptic or obovate, apex shortly and abruptly acuminate, acumen blunt or acute, base narrowed or cuneate, up to c. 20 cm.  $\times$  9.5 cm., upper surface rather dark shining green and more or less bullate in life, dark brown when dry, minutely black dotted, lower surface paler green, drying brown and minutely black dotted; midrib impressed above, prominent and rounded below; *primary nerves* up to c. 16 pairs, impressed above, prominent below, running nearly straight or curving gently up to a conspicuous intramarginal nerve c. 5 mm. from leaf margin; secondaries few, fine, reticulations lax, hardly visible; petiole stout, up to c. 1 cm. long, black when dry.

*Panicles* terminal, branched from base, up to c. 16 cm. long, branches distant, the lower ones ascending, the upper nearly horizontal and shorter, green in life and somewhat angled or compressed, brownish and striate when dry; *flowers* sessile or sometimes on very short stout pedicels, in twos or threes, or occasionally subcapitate at the ends of the ultimate branchlets, bracts and bracteoles minute, persistent, triangular acute, 3 at base of each flower; *calyx* yellowish shading to greenish at base, gland dotted, obconic, without pseudostalk, c. 3 mm. long, lobes 5, very small and distant, broadly triangular acute, less than 0.5 mm. tall; *petals* 5, white, falling as a calyptra but not agglutinated, more or less orbicular, c. 1.5–2 mm. diam., with sparse yellow gland dots; *stamens* c. 25, from 0.5–2 mm. long, filaments strap-shaped at base, subulate above, anthers small, connective gland yellowish; *style* narrowly conical, c. 1 mm. tall; *ovary* 2-celled.

*Fruit* pink when ripe with inconspicuous white dots, or white on one side, more or less globose, oblong globose or depressed globose, c. 4–5 mm. diam., 3.5–4 mm. tall, apical umbilicus shallow and rather wide, c. 1.5–2 mm. diam., bearing the hardly enlarged incurved calyx lobes and remains of stamens and style base; pericarp juicy, white, rather thick, nearly 1 mm. in places; seed 1, more or less reniform or oblong, c. 3.5 mm. long, cotyledons superposed, outer surface inconspicuously gland dotted, more or less equal, inner faces oblique, nearly plane, attached to hypocotyle at periphery, the small radicle and plumule sunk in a slight fold in the edge of one cotyledon.

The larger and broader leaves with more pronounced venation distinguish this variety from the typical form.

108. *Eugenia myriantha* King, Mat. F.M.P., No. 12, 125 (1901); Ridl., F.M.P., I, 745. (Fig. 40j).

PERAK: sine loc., *Scortechini 337* (type collection).

Distrib: Endemic.

A tall tree. Twigs terete. Leaves very coriaceous, elliptic lanceolate to oblanceolate, apex subacute, base narrowed, up to c. 4.5 cm.  $\times$  2 cm., upper surface polished, drying pale brown, punctate, lower surface dull, darker brown, subglaucous; midrib impressed above, elevate below; primary nerves 3 or 4 pairs, ascending, distant, very faint and obscure on both surfaces, reticulation invisible; petiole up to c. 8 mm. long.

Panicles terminal or from upper leaf axils, numerous, pedunculate, up to c. 7 cm. long, the branches numerous and spreading, rather slender, angled; flowers sessile in clusters at ends of the short quadrangular branchlets, subtended by minute subpersistent broad bracteoles; calyx cylindric, c. 2 mm. long.

Known only from one collection. This species approaches some forms of *E. pseudosubtilis* and may not be more than a variety of that variable species. The leaves, however, are much smaller and thicker than in any form of *E. pseudosubtilis* that I have seen, the upper surface pitted and the nerves obscure on both surfaces.

There is no indication of the locality on the label, but the appearance of the specimens suggests that it is a mountain or ridge top plant, although a note, ? in Scortechini's hand, pinned to one sheet in Herb. Calcutta, describes it as a tall tree.

109. *Eugenia Kunstleri* King, Mat. F.M.P., No. 12, 127 (1901); Ridl., F.M.P., I, 746. *E. albidiramea* Merr. in Univ. Calif. Publ. Bot., XV, 221 (1920). *Syzygium albidirameum* (Merr.) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 190 (1939). (Fig. 39d).

KEMAMAN: Bukit Kajang, 500 feet, SFN 30322, 30420, 30492 (Corner).

PENANG: sine loc., *Curtis 179* (syntype).

PERAK: Larut, up to 800 feet, *Kunstler 3310* (syntype), 200-500 feet, *Kunstler 3680* (syntype).

JOHORE: 5½ mile, Kota Tinggi-Mawai road, SFN 29301 (Corner); Sungai Sedili, SFN 36920 (Corner).

SINGAPORE: Botanic Gardens, *Ridley 6418*; Mandai road, SFN 37725 (Kiah).

Distrib: Borneo.

A tree reaching c. 24-25 m. tall, trunk cylindric or slightly fluted at base; bark distinctly though thinly papery flaky, slightly pustulate with scattered lenticels, pallid rufous fawn or orange rufous; inner bark rather thick, pale pinkish or brownish buff or yellowish brownish, turning

mauvisch or brownish on exposure; wood pallid buff. *Twigs* slender, terete, bark smooth and somewhat polished, drying pale, the youngest shoots obscurely quadrangular with brown pustulate bark. *Leaves* thinly coriaceous, oblong lanceolate or elliptic lanceolate to ovate lanceolate or narrowly elliptic, apex acuminate, base cuneate or long narrowed, from c. 6.5–19 cm. long and 3–6 cm. broad, upper surface dull, drying brown to blackish brown, very minutely and closely black dotted, punctate or obscurely pustulate, lower surface brown or reddish brown, minutely glandular pustulate; midrib narrowly and deeply impressed above, prominent below, rugose pustulate; *primary nerves* 8–12 pairs, c. 1–15 cm. apart, more or less impressed above and rather faint, bold below, more or less pustulate, nearly straight or curving up to a bold looped intramarginal nerve c. 4–5 mm. from leaf margin, with a much fainter series of loops close to the margin; secondaries and lax reticulations usually invisible above, very fine and faint below; petiole up to c. 1.5 cm. long, rather slender, rugose when dry, deeply channelled above.

*Panicles* terminal or from upper leaf axils, often clustered, shortly pedunculate, reaching c. 12 cm. long but usually much shorter than the leaves, peduncle, rachis and the many spreading branches slender, 4-angled, drying brown and minutely pustulate; *flowers* sessile or occasionally on very short stout pedicels, in threes at ends of the short ultimate branchlets; calyx green, petals and filaments white; *calyx* funnel shaped, quadrangular, c. 3 mm. long and 2 mm. across mouth, narrowed at base or contracted rather suddenly into a pseudostalk varying from less than 0.5 mm. to c. 1 mm. long; mouth with 4 obscure broad rounded subpersistent lobes less than 0.4 mm. tall; *petals* 4, free, orbicular, 1.5–2 mm. diam., or falling in a calyptra, either completely agglutinated or partially so; *stamens* about 20, filaments rather stout, flattened, less than 1 mm. long, anthers elliptic, c. 0.3 mm. long, connective gland small; *style* rather slender, c. 0.7 mm. long; *ovary* 2-celled.

*Fruit* ovoid or obovoid, c. 1.5 cm. long, 1.25 cm. across, smooth, somewhat narrowed at base, apical umbilicus very shallow, c. 3 mm. diam., fringed by the very short calyx rim; pericarp thin and tough, seed with large blunt conspicuous hypocotyle reaching periphery.

*E. albidiramea* Merr. is known from fruiting specimens only, but although the fruit of the type (*Elmer 21762*) is larger and more deeply wrinkled than in any Malayan collection, that of *Elmer 21518*, cited in the original description, corresponds exactly to several of our collections,

and two flowering collections which match the type of *E. Kunstleri* very closely have been made in Borneo. They are *SFN 36098* (Daud & Tachun) from Gunong Gading, Sarawak, and *SFN 26869* (Carr) from Tenompok, Mt. Kinabalu.

This species is allied to *E. pustulata* but differs in the less oblong leaves, the more slender inflorescence branches and the smaller flowers.

110. *Eugenia polyantha* Wight, Ill. II, 17 (1841); Duthie in Hook. fil., F.B.I., II, 496; King, Mat. F.M.P., No. 12, 103; Ridl., F.M.P., I, 742; Koord. & Valet. in Meded. Lands Plantent., XL, 88; Atlas Baumart. Java, III, figs. 470, 471; Craib, Fl. Siam. Enum., I, 656; Corner, Wayside Trees of Malaya, p. 501, pl. 152, 153, fig. 168. *Syzygium polyanthum* (Wight) Walp., Repert., II, 180 (1843); Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 155. *Eugenia balsamea* Ridl., F.M.P., I, 754, non Wight. *E. Junghuhniana* Miq., Fl. Ind. Bat., I, i, 444 (1855). *E. nitida* Duthie in Hook. fil., F.B.I., II, 496 (1878). (Fig. 40a).

Widely distributed from Langkawi and Kelantan to Singapore, in lowland forest and secondary growth and in villages, commonest in the south of the Peninsula.

*Distrib*: Burma, Siam, Indo-China, Sumatra, Borneo, Java.

A rather slender tree up to c. 24 m. tall; bark creviced into small regular inconspicuous rectangular pieces, not or slightly flaky, rather thick, pale grey or whitish grey; inner bark thick, pink, turning mauvish on exposure; wood pale. *Twigs* terete, drying reddish brown or greyish brown, bark somewhat flaky. *Leaves* thinly coriaceous, narrowly elliptic, lanceolate, oblong elliptic or oblong oblanceolate, usually shortly and bluntly acuminate, sometimes caudate acuminate, base cuneate, from c. 7–16 cm. long and 2.5–7 cm. broad; upper surface drying dull or slightly shiny, dark brown to almost black, minutely punctate, dull below and brown or reddish brown, closely pellucid dotted in life, minutely black dotted or pustulate when dry; midrib impressed above, prominent below; *primary nerves* c. 7–11 pairs, 0.5–1 cm. or more apart, usually faint above, slightly prominent below and usually quite distinct, spreading or obliquely ascending, nearly straight or slightly curved to an intramarginal nerve 2–4 mm. from leaf margin; secondaries and reticulations usually faint or obscure; petiole usually c. 0.5 cm. long, rarely as much as 1 cm.

*Panicles* usually from the young twigs below the leaves, sometimes axillary, numerous, up to c. 5 cm. long but occasionally as much as 10 cm. long, peduncled or branched

from near base, the rachis and short divaricate branches slender, 4-angled or compressed, bracts and bracteoles minute, subpersistent, triangular acute; *flowers* faintly fragrant, calyx greenish, petals and stamens white, sessile, usually in threes at the ends of the branches or of the short branchlets; *calyx* campanulate, narrowed into a short pseudostalk, tube c. 2 mm. long; lobes 4, green, broadly ovate rounded, c. 1.5 mm. tall, the two outer thinner and slightly larger than the two inner, conspicuously pellucid dotted; *petals* 4, free, thin, broadly ovate rotund, conspicuously pellucid dotted, c. 3 mm. across and 2.5 mm. tall, the two outer ones often retuse, quickly deciduous; *stamens* numerous, filaments subulate, gland dotted, up to c. 4 mm. long, anthers oblong ovate, c. 0.4 mm. long, connective gland small; *style* terete, narrowly conic, apex truncate, c. 2 mm. long; *ovary* 2-celled, multiovulate. After the petals fall the calyx opens out into a flat pinkish disc and the calyx lobes shrivel and turn pink.

*Fruit* green when full grown, ripening deep pink or dull dark scarlet to purple black, globose to depressed globose, c. 1.2 cm. diam., apical umbilicus shallow, 3-4 mm. diam., bearing on its margin the 4 enlarged persistent fleshy calyx lobes; pericarp c. 2 mm. thick, juicy and pulpy, whitish tinged pink, faintly sweet; seed depressed globose, c. 7 mm. diam., testa pale brown, thin, adhering to the green rugose and gland dotted surface of the cotyledons; cotyledons side by side, inner faces green, gland dotted, nearly plane, sessile, attached to the stout hypocotyle near periphery. Germination hypogeal.

**E. polyantha** Wight var. *sessilis* var. nov.

A *typa floribus fasciculatis differt.*

JOHORE: Sungai Kayu, in swampy forest, a tree 30-35 feet tall, SFN 32413 (*Kiah*), TYPE collection, holotype in Herb. Singapore.

At first sight this looks different from the typical form, but the foliage and flowers conform and the only difference is in the entire absence of inflorescence rachis.

111. **Eugenia Koordersiana** King, Mat. F.M.P., No. 12, 128 (1901); Ridl., F.M.P., I, 732. (Fig. 40b).

PERAK: Larut, within 100 feet, *Kunstler* 6208, 6385 (syntypes), 300-500 feet, *Kunstler* 6233 (syntype); Pondok Tanjong, Forest Dept. FMS 11792, 11798; sine loc., *Scortechini* s.n., 257 (syntype).

SELANGOR: sine loc., *Burn-Murdoch* s.n.

*Distrib.*: Endemic.

A tree up to c. 24 m. tall. *Twigs* terete, smooth, blackish brown when dry. *Leaves* coriaceous, narrowly elliptic or narrowly ovate elliptic, rarely oblanceolate, apex

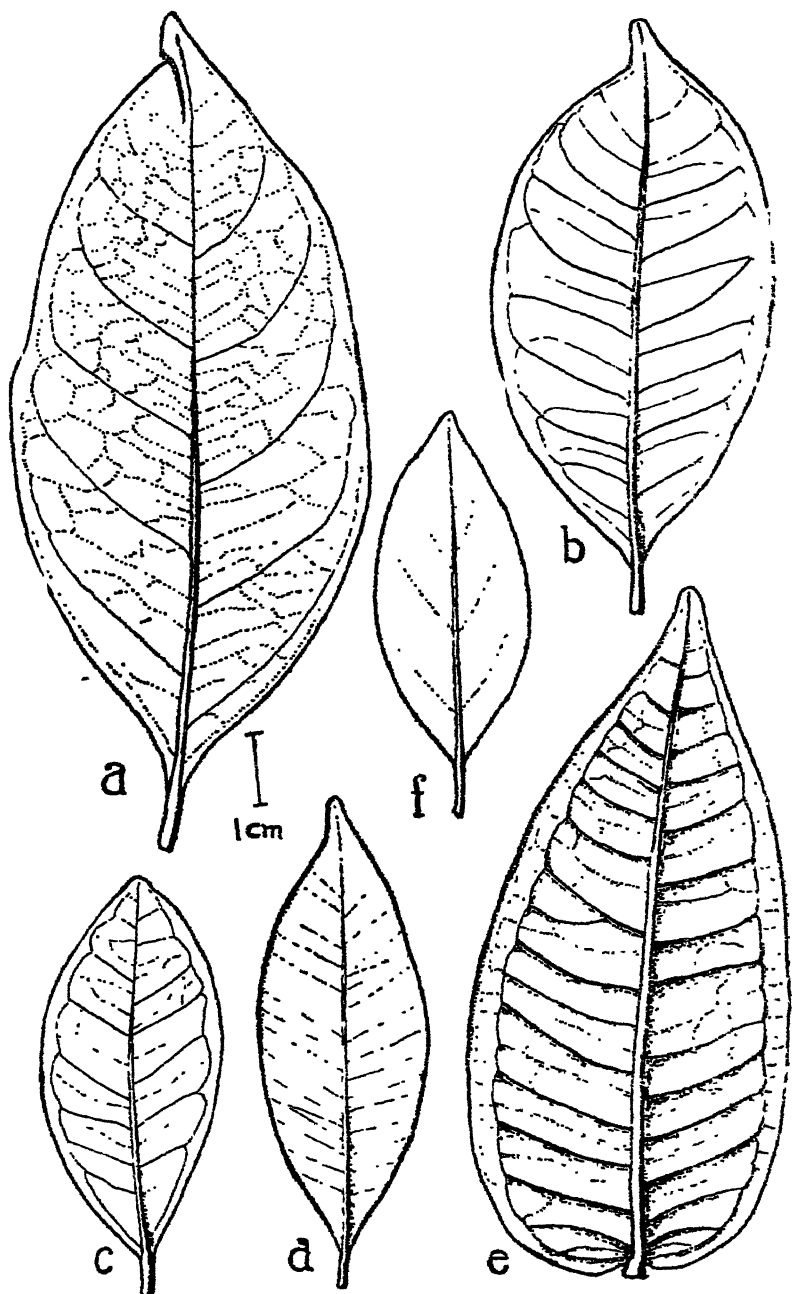


Fig. 40. a, *E. polyantha*; b, *E. Koordersiana*; c, *E. orites*; d, *E. alyxifolia*; e, *E. tetraptera* var. *pseudotetraptera*; f, *E. myriantha*.

shortly and abruptly acuminate, base cuneate, from c. 5 cm.  $\times$  2.5 cm. to 11 cm.  $\times$  5 cm., both surfaces drying very dark brown to blackish brown, the lower slightly paler; midrib impressed above, prominent below; *primary nerves* 8–14 pairs, impressed above, fine but slightly elevate and distinct below, curving up to a shallowly looped intramarginal nerve c. 2–4 mm. from leaf margin, with a very faint series of loops nearer the margin, reticulations invisible above, very slightly raised and rather indistinct below; petiole from c. 5 mm. to nearly 1 cm. long.

*Panicles* terminal or occasionally from upper leaf axils, often clustered, pedunculate, usually longer than the leaves, corymbose, with several pairs of spreading or obliquely ascending branches up to c. 4 cm. long, they and the rachis sharply or obtusely 4-angled with dark smooth bark; *flowers* white, sessile, in threes or fives at ends of branches or of short rather slender branchlets, buds clavate; *calyx* campanulate, c. 4 mm. long and 2 mm. across mouth, somewhat 4-angled, rather gradually contracted into a short not well defined pseudostalk; lobes 4, deep, broad, and rounded, c. 2 mm. across and 1.2 mm. tall, caducous; *petals* 4, probably falling as a calyptra, but free, more or less orbicular, 3.5–4 mm. diam.; *stamens* numerous, filaments slender, up to 5–6 mm. long, anthers broadly elliptic, c. 0.3 mm. long, connective gland distinct; *style* stouter than filaments, c. 6 mm. long; *ovary* 2-celled.

Merrill and Perry point out that *E. Koordersiana* is very closely allied to *Syzygium confertum* (Korth.) Merr. & Perry. I have seen only *Elmer 20126* of the specimens cited by Merrill and Perry and on the basis of this collection the two species are certainly very close, but *E. Koordersiana* has the primary nerves impressed above in all the material seen, and the branchlets have darker bark. It is better to keep the two species separate until *E. Koordersiana* is better known.

112. *Eugenia orites* Ridl., F.M.P., V (Suppl.), 308 (1925). (Fig. 40c).

JOHORE: Gunong Belumut, 3,000 feet, *SFN 10722* (Holtum), type collection.

A tree. *Twigs* rather slender, terete, bark smooth, drying greyish or blackish brown. *Leaves* thickly coriaceous, elliptic lanceolate, apex narrowed and blunt, base cuneate, up to c. 5.5 cm.  $\times$  2.5 cm., both surfaces drying reddish brown, dull, the upper minutely punctate; midrib narrowly impressed above, elevate below; *primary nerves* 4–7 pairs, 5–8 mm. apart, slightly raised and rather indistinct above, raised and distinct below, obliquely ascending

to an intramarginal nerve 2-3 mm. from the more or less recurved leaf margin, reticulation obscure above, less distinct below than the primaries; petiole up to c. 7 mm. long, rather stout.

*Cymes* terminal, usually several together, or occasionally from upper leaf axils, up to c. 4 cm. long, rachis slender, angled and longitudinally wrinkled, drying dark, with three sessile flowers at its apex and often a pair lower down; *calyx* campanulate, c. 8 mm. long and 6 mm. across mouth after anthesis, narrowed gradually to a pseudostalk 2-3 mm. long; lobes 4, thick with thin margins, suborbicular, c. 4 mm. diam., quickly deciduous and leaving a truncate-undulate calyx limb; *petals* not seen; *stamens* with very slender filaments, c. 6 mm. long, anthers ovate, c. 0.5-0.6 mm. long, connective gland rather conspicuous; *style* much stouter than filaments, subulate, c. 6 mm. long; *ovary* 2-celled.

A little known plant only once collected, but distinct in the small leaves, cymose inflorescence with few rather large flowers and the large, quickly deciduous calyx lobes.

*SFN 28907 (Symington & Kiah)* from Gunong Tapis, Kuantan, Pahang, alt. 4,600 feet, may be this, but it has much larger leaves, a shorter inflorescence and somewhat larger flowers with longer styles.

113. *Eugenia alyxifolia* Ridl. in Journ. Bot., 296 (1924); F.M.P., V (Suppl.), 309 (1925). (Fig. 40d).

PAHANG: Fraser Hill, 4,000 feet, *SFN 11213 (Nur)*, type collection.

A *shrub*. *Twigs* slender, the youngest acutely 4-angled, bark drying dark, minutely rugulose pustulate, older twigs obtusely 4-angled or terete, bark drying smooth and yellowish or greyish. *Leaves* coriaceous, lanceolate or narrowly oblong lanceolate, apex shortly and bluntly acuminate, base narrowed, up to c. 7 cm.  $\times$  2.5 cm.; upper surface drying blackish brown, closely pitted, lower surface paler, reddish brown, minutely rugulose pustulate; midrib impressed above, prominent below and keeled towards the petiole; *primary nerves* 15-20 pairs, 3-5 mm. apart, almost invisible above, slightly raised and faint below, curving slightly to a very faint intramarginal nerve close to and hidden by the recurved leaf margin; petiole from 0.5-1 cm. long.

*Panicles* terminal, very short, c. 1 cm. long and 1.5-2 cm. across, sessile and branched from base, branches short, crowded, spreading, 4-angled; *flowers* white, sessile in threes at the ends of very short branchlets, buds narrowly

obconic truncate, c. 3.5 mm. long; *calyx* after anthesis funnel shaped or somewhat campanulate, narrowed gradually to base, pseudostalk not sharply marked off; lobes 4, short, broad and rounded, obscure, incurved in bud; *petals* falling in a thick flat calyptra c. 1.5 mm. diam.; *stamens* less than 30, filaments stout, flattened below, reaching a little more than 1 mm. long, anthers ovate elliptic, c. 0.2 mm. long, connective gland distinct; *style* rather stout, narrowly conical, c. 1 mm. long; *ovary* 2-celled.

Collected only once, but distinct in the narrow leaves closely pitted above and in the very short inflorescences with very small flowers.

114. *Eugenia pseudocrenulata* nom. nov. (Fig. 41).

*E. crenulata* Duthie in Hook. fl., F.B.I., II, 490 (1878); King, Mat. F.M.P., No. 12, 91; Ridl., F.M.P., I, 751; non Willd. (1800).

KEMAMAN: Bukit Kajang, 500 feet, *SFN 30456* (Corner), leaf specimens matching the type very closely.

PERAK: Kledang Saiiong Forest Reserve, *Forest Dept. FMS 33754*, leaf specimens.

MALACCA: sine loc., *Maingay K.D. 739* (type collection).

SINGAPORE: Selitar, *Ridley 6232*; Mandai road, *SFN 28090* (Corner).

*Distrib*: Endemic.

A tree up to c. 12 m. tall, trunk slightly fluted and stilt rooted at base; bark entire, lenticellate or bumpy, or tessellately cracked in small patches, warm brown or greyish rufous; inner bark thick, deep pink brown or deep red brown, with dark brown gummy transversely elongate tannin cavities, very astringent; wood buff white. *Twigs* terete, bark drying brown and finely wrinkled. *Leaves* thickly coriaceous, stiff, dark green above and yellowish below in life, elliptic or elliptic rotund to narrowly oblong elliptic, apex rounded or somewhat narrowed with a short apiculus, or shortly and broadly acuminate, base cuneate, from c. 10–20 cm. long and 5–10 cm. broad, upper surface drying olivaceous to almost black, usually somewhat polished, often with large scattered gland pits, lower surface duller, reddish or dark brown, conspicuously dark gland dotted in life; midrib impressed above, prominent below and longitudinally wrinkled or keeled; *primary nerves* c. 30 pairs, usually c. 0.5 cm. apart, raised and distinct on both surfaces, more prominent below, obliquely ascending to a distinct intramarginal nerve 2–3 mm. from the shallowly and rather obscurely crenate leaf margin; secondaries and numerous reticulations almost as distinct on both surfaces as primaries; petiole stout, drying black and wrinkled, up to c. 2 cm. long.

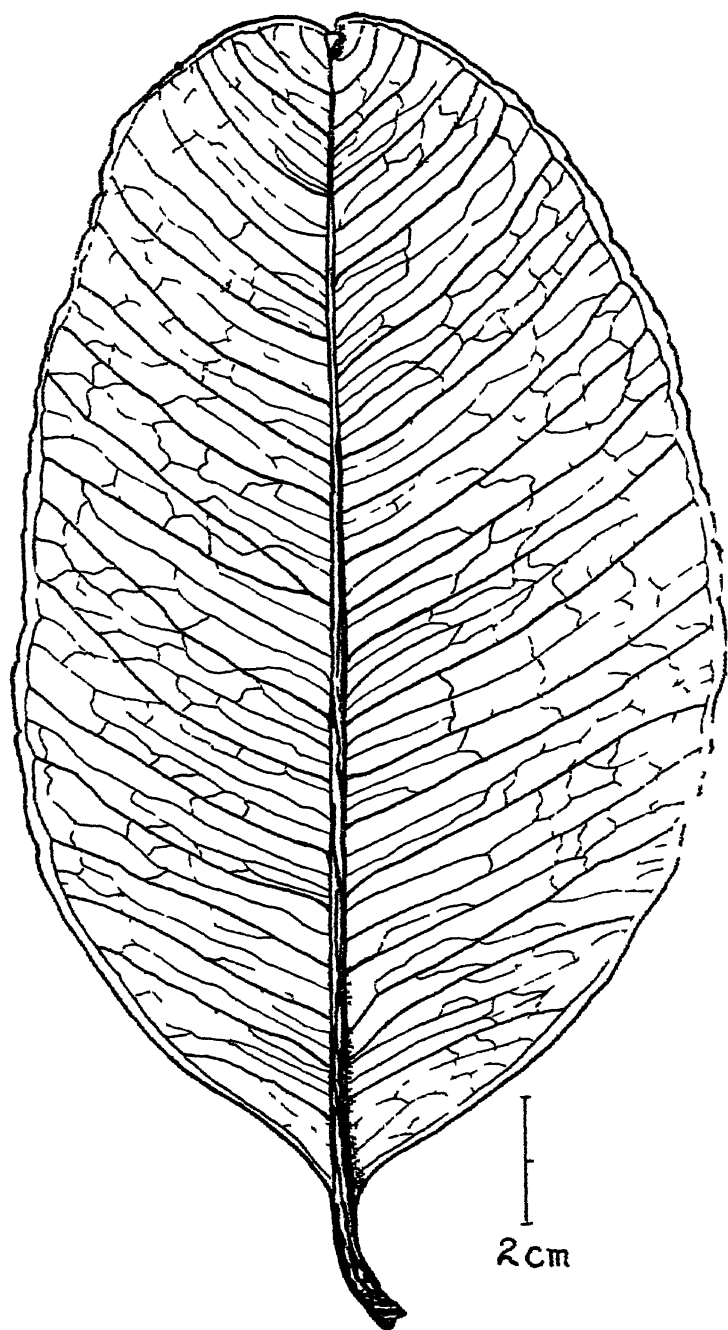


Fig. 41. *E. pseudocrenulata*.

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*Panicles* terminal, up to c. 18 cm. long, on long peduncles, corymbose, trichotomous, peduncles and branches rather slender, obtusely 4-angled, bracts and bracteoles subpersistent, minute, narrowly triangular acute; *flowers* numerous, sessile in threes at the ends of the short ultimate branchlets; *calyx* after anthesis funnel shaped or narrowly campanulate, c. 4 mm. long and 3 mm. across mouth, tapered to base and rather suddenly contracted into a short pseudostalk c. 1 mm. long; lobes apparently 4, large and rounded, thin, quickly deciduous; *petals* falling in a thick gland dotted calyptra c. 3 mm. diam.; *stamens* numerous, filaments slender, c. 4 mm. long, anthers broadly ovate elliptic c. 0.4 mm. diam., connective gland distinct; *style* much stouter than filaments, c. 3.5 mm. long; *ovary* 2-celled, multiovulate.

*Fruit* ripening pallid watery white, depressed globose, c. 1 cm. long and 1.5–1.75 cm. across, apical umbilicus c. 2 mm. diam., the calyx rim not prominent; pericarp c. 2–3 mm. thick; seed c. 0.75 cm. long and 1 cm. wide, more or less conforming to shape of fruit but slightly compressed laterally; testa rather thin, leathery crustaceous, not membranous, adhering closely to cotyledons; cotyledons juxtaposed, nearly equal, their surfaces smooth with distant conspicuous dark gland dots, inner faces nearly plane, similarly gland dotted, attached to hypocotyle near their centres by very short broad stalks.

A little known species which seems to be very distinct in its large stiff crenate leaves with the venation raised on both surfaces, and in the large panicles of small flowers.

115. *Eugenia tetraptera* (Miq.) comb. nov. (Fig. 42).

*Jambosa tetraptera* Miq., Fl. Ind. Bat., Suppl. I, 311 (1860–62).

SELANGOR: Sungai Buloh Forest Reserve, Ridley 13345, Forest Dept. FMS 2283, 27135, 29791.

Distrib: Sumatra (Penasa, Siak, Ridley 8987), Bangka (type).

A ?tree. *Twigs* slender, the youngest quadrangular with short coarse rufous glandular hairs, the angles with very conspicuous very wavy membranous wings, older twigs terete with pale flaky bark. *Leaves* thinly coriaceous, narrowly ovate or ovate oblong or ovate lanceolate, apex shortly and bluntly acuminate, base rounded and minutely cordate, 4 cm.  $\times$  2 cm. to 7 cm.  $\times$  3.5 cm.; upper surface drying dark brown, somewhat polished, minutely and closely punctate, lower surface reddish brown; midrib deeply impressed above, prominent below and conspicuously tuberculate, especially towards base; *primary nerves* c. 10

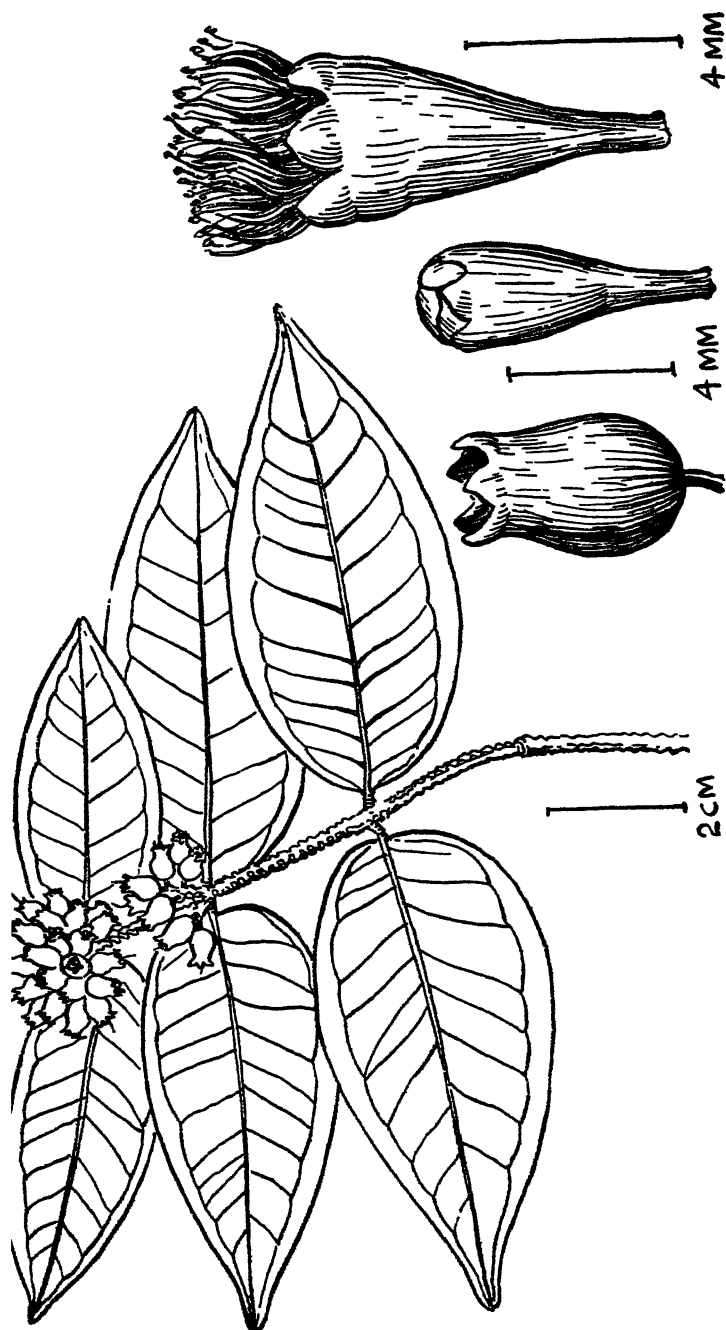


Fig. 42. *E. tetraaptera*.  
Del: CHAN YORR CHYE.

pairs, impressed above and very distinct, prominent below, almost straight or curving slightly to a prominent shallowly looped intramarginal nerve 3-4 mm. from leaf margin, with a much less prominent series of loops c. 1 mm. from margin; reticulations invisible above, slightly raised and broad below, much less distinct than primaries; petiole very short, stout, closely wrinkled-tuberculate.

*Flowers* sessile, in terminal or axillary pseudo-umbellate sessile or almost sessile heads reaching c. 2 cm. diam., closely crowded and bracteate, the bracts not very conspicuous, subpersistent, linear oblong, keeled, c. 3 mm. long; *calyx* narrowly cylindric funnel shaped, 7-8 mm. long, c. 3 mm. across mouth, glaucous and longitudinally wrinkled, rather abruptly narrowed at base into a slender pseudostalk c. 2-3 mm. long; lobes 5, conspicuous, persistent, oblong ovate blunt, about 1 mm. across and 1 mm. tall; *petals* falling in a calyptra c. 2.5 mm. diam.; *stamens* numerous, filaments very slender, up to c. 6-7 mm. long, anthers ovate, 0.2-0.3 mm. long, connective gland large and conspicuous; *style* much stouter than filaments, c. 8 mm. long; *ovary* 2-celled.

**E. tetraptera** (Miq.) Henderson var. **pseudotetraptera** (King) var. nov. *Eugenia pseudotetraptera* King, Mat. F.M.P., No. 12, 109 (1901); Ridl., F.M.P., I, 739. (Fig. 40e).

PAHANG: Cameron Highlands, 5,000 feet, SFN 18050 (Henderson & Whitty), Forest Dept. FMS 31018; Sungai Bertam, Cameron Highlands, Forest Dept. FMS 36265; Fraser Hill, Forest Dept. FMS 45413.

JOHORE: Gunong Panti, 1,600 feet, Ridley 4197, TYPE collection of *E. pseudotetraptera* King and of var. *pseudotetraptera*, holotype in Herb. Singapore; Sungai Kayu, Mawai-Jemaluang road, SFN 32018 (Corner); Sungai Sedili, Corner s.n.

*Distrib:* Karimon Islands (Ridley 348).

King remarks that his species is very near *Jambosa tetraptera* Miq., and I do not think it can be held to be more than a variety. King, of course, did not see the Sungai Buloh specimens here placed under Miquel's species. The variety differs from the type only in the much more conspicuous and persistent bracts, and in the absence of the rufous glandular hairs on the young stems and of the tuberculations on the midrib of the leaf below.

The *fruit* is c. 7-8 mm. diam., globular, crowned by the short wide calyx rim and lobes; seed 1, globular, cotyledons side by side, nearly equal, conspicuously gland dotted, inner faces folded and excavate, attached near their centres to the large hypocotyle which reaches the periphery of the seed.

The specimens from Sungai Buloh cited above under Miquel's species are a close match for a sheet of *Tegsmanii* 3507 preserved in Herb. Calcutta, which is doubtless part of the type collection. *Ridley 13345* has the pseudo-umbellate inflorescence of the type, but the other specimens show a tendency to a paniculate inflorescence which may be due simply to the dropping of the leaves in the axils of which the inflorescences arise, along with a tendency to produce the inflorescences on short peduncles. The typical form of the variety has the flowers in sessile glomeruli, but in other specimens the inflorescence is pseudo-paniculate, again apparently due to the dropping or suppression of leaves and development of short peduncles. This creates an inflorescence very similar to that of *E. polita* King.

*Syzygium pterophorum* Merr. & Perry in Mem. Amer. Acad. Arts and Sci., XVIII, 3, 158 (1939), of which I have seen a duplicate of *Clemens 31300* (cited in the original description) and *SFN 27096* (Carr) is very close to *E. tetraptera* var. *pseudotetraptera*, differing only in the pustulate, not glaucous and longitudinally wrinkled calyx tube, the shorter pseudostalk, and possibly in the more quickly deciduous bracts.

116. *Eugenia polita* King, Mat. F.M.P., No. 12, 110 (1901); Ridl., F.M.P., I, 739; Corner, Wayside Trees of Malaya, p. 501, fig. 168. (Fig. 43a, b, c).

KEDAH: Jerai Forest Reserve, Forest Dept. FMS 17932; Kedah Peak, 3,000 feet, *Ridley 5208*.

PENANG: sine loc., *Wallich 3620*; Government Hill, 1,200 feet, *Curtis 511* (syntype).

PERAK: sine loc., *Scortechini s.n.*, *Wray 2822* (syntype); Haram Parah, *Scortechini 585* (syntype); Larut, 2,500–3,000 feet, *Kunstler 6903* (syntype); near Ulu Kerling, 400–600 feet, *Kunstler 8679* (syntype); Gopeng, 500–1,000 feet, *Kunstler 5780*.

SELANGOR: Bukit Cheraka Forest Reserve, Forest Dept. FMS 13023.

MALACCA: Sungai Udang, *Holmberg 859* (syntype, cited by King as *Ridley's* number).

PAHANG: Kuantan, Forest Dept. FMS 6682; Fraser Hill, 4,000 feet, *SFN 33207* (Corner).

JOHORE: Kuala Sembrong, *Lake & Kelsall 4078* (syntype, cited by King as *Ridley's* number); Kukub, Forest Dept. FMS 6057; Pulau Setindan. near Mersing, *SFN 29769* (Corner).

Distrib: Endemic.

Usually a shrub or small tree but reaching 24–25 m. tall; bark thinly flaky, rufous orange. Twigs slender,

acutely 4-angled, more or less winged, the wings sometimes broad and wavy, bark drying pale brown, smooth or flaky. *Leaves* coriaceous or thickly coriaceous, narrowly lanceolate to ovate lanceolate, apex acuminate, sometimes shortly and bluntly, sometimes caudate acuminate, base broadly cuneate or rounded, variable in size, from c. 45 cm.  $\times$  1.75 cm. to c. 9 cm.  $\times$  3.5 cm. or 6 cm.  $\times$  3.5 cm., both surfaces shining when dry, the upper liver brown to blackish brown, more or less punctate, lower surface paler and more reddish brown, with scattered black dots; midrib impressed above, usually raised below, sometimes nearly flat; *primary nerves* up to c. 14 pairs, spaced, faint or invisible above, sometimes raised below and quite distinct, sometimes obscure or almost invisible, meeting in an obscure intramarginal nerve close to the leaf margin; petiole very short, drying black and wrinkled.

*Panicles* axillary and terminal, shorter than the leaves, condensed, usually not more than c. 2–3 cm. long, branches and rachis rather stout, 4-angled and more or less winged, bark drying pale brown and smooth, bracts persistent, very numerous and conspicuous, those at base of panicle narrow with long subulate points, c. 3 mm. long, those subtending the branches oblong ovate or obovate, rounded, conspicuously gland dotted, c. 4 mm. long and 3.5 mm. broad, those subtending the flowers from broadly oblong to linear oblong, blunt, 4–5 mm. long; *flowers* sessile, the bracts overtopping them at least in bud, *calyx* cylindric-funnelshaped, c. 5 mm. long and 3 mm. across mouth, contracted at base into a very short pseudostalk, tube slightly wrinkled; lobes 5, conspicuous, persistent, erect, broadly ovate rounded, c. 12 mm. across and 1 mm. tall; *petals* calyptrate; *stamens* c. 2 mm. long, filaments slender, anthers oblong ovate, 0.4–0.5 mm. long, connective gland distinct; *ovary* 2-celled.

*Fruit* greenish white with very fine dark mottling, more or less globose or ovoid globose, 8–9 mm. long and 7–8 mm. across, crowned by the calyx rim c. 1 mm. high and 2 mm. across, bearing the erect slightly incurved enlarged calyx lobes c. 2 mm. tall, ?falling when the fruit is fully ripe; pericarp thin, testa dark brown; seed black, nearly globose or slightly oblong globose, 6–7 mm. diam., surface of cotyledons slightly mucilaginous and minutely pitted; cotyledons intense purple, side by side, commissure wavy; inner faces interlocking, point of attachment hidden under fold, hypocotyle large, more or less warty, terete, reaching periphery of seed.

117. *Eugenia tecta* King, Mat. F.M.P., No. 12, 109 (1901); Ridl., F.M.P., I, 739. (Fig. 43d, e).

PERAK: Larut, within 100 feet, *Kunstler 1863* (type collection); Bukit Blakang Parang, near Gunung Bintang, *SFN 21068* (*Haniff*).

*Distrib*: Endemic.

A small tree. *Twigs* slender, acutely 4-angled, the youngest parts narrowly winged on the angles, bark drying dark brown, smooth, becoming flaky. *Leaves* thinly coriaceous, ovate lanceolate to oblong lanceolate or oblong ovate, apex acuminate, base rounded and more or less cordate, up to c. 9.5 cm. long and 4 cm. broad; both surfaces drying pale brown or pale reddish brown, the upper slightly darker, somewhat polished, sparsely punctate, the lower dull, minutely and sparsely dark gland dotted; midrib impressed above, elevate below, with small scattered tubercles; *primary nerves* numerous (about 20 pairs), very slightly raised and very faint on both surfaces, invisible in some leaves, nearly horizontal and curving up to an obscure nearly straight intramarginal nerve 1–2 mm. from leaf margin; petiole 2–4 mm. long, densely tuberculate, drying black.

*Flowers* "golden", crowded in terminal or axillary fascicles, sessile, bracteoles small and subsistent; *calyx* wrinkled and subglaucous when dry, funnel shaped, 10–11 mm. long and 4 mm. across mouth, tapered to base and contracted into a slender pseudostalk 1.5–3 mm. long; lobes 5, persistent, erect, ovate triangular subacute, c. 2 mm. across and 1.5 mm. tall; *petals* 5, free, ovate orbicular, with large pellucid gland dots, c. 4 mm. diam.; *stamens* numerous, filaments slender, up to c. 8 mm. long, anthers oblong, c. 0.5 mm. long connective gland large and conspicuous.

*Fruit* globular, 7–8 mm. diam., with large scattered pellucid gland dots, apical umbilicus wide and rather deep, fringed by the erect, slightly enlarged calyx lobes; seed globose, c. 6 mm. diam., cotyledons superposed, nearly equal, commissure wavy, inner faces gland dotted, deeply excavate and folded, attached near their centres by short broad stalks to the very large angled and warted hypocotyle which reaches the periphery of the seed and is there truncate and broadened.

118. *Eugenia jasminifolia* Ridl. in Journ. F.M.S. Mus., X, 133 (1920); F.M.P., I, 740. (Fig. 43f).

KELANTAN: Sungai Ketch, *SFN 11993* (*Nur*); Gunung Sitong, Forest Dept. *FMS 37751*.

TRENGGANU: sine loc., Forest Dept. *FMS 26910*.

PERAK: Kledang Saiong, Forest Dept. *FMS 25795*.

MALACCA: base of Gunung Mering, *Ridley 3299*.

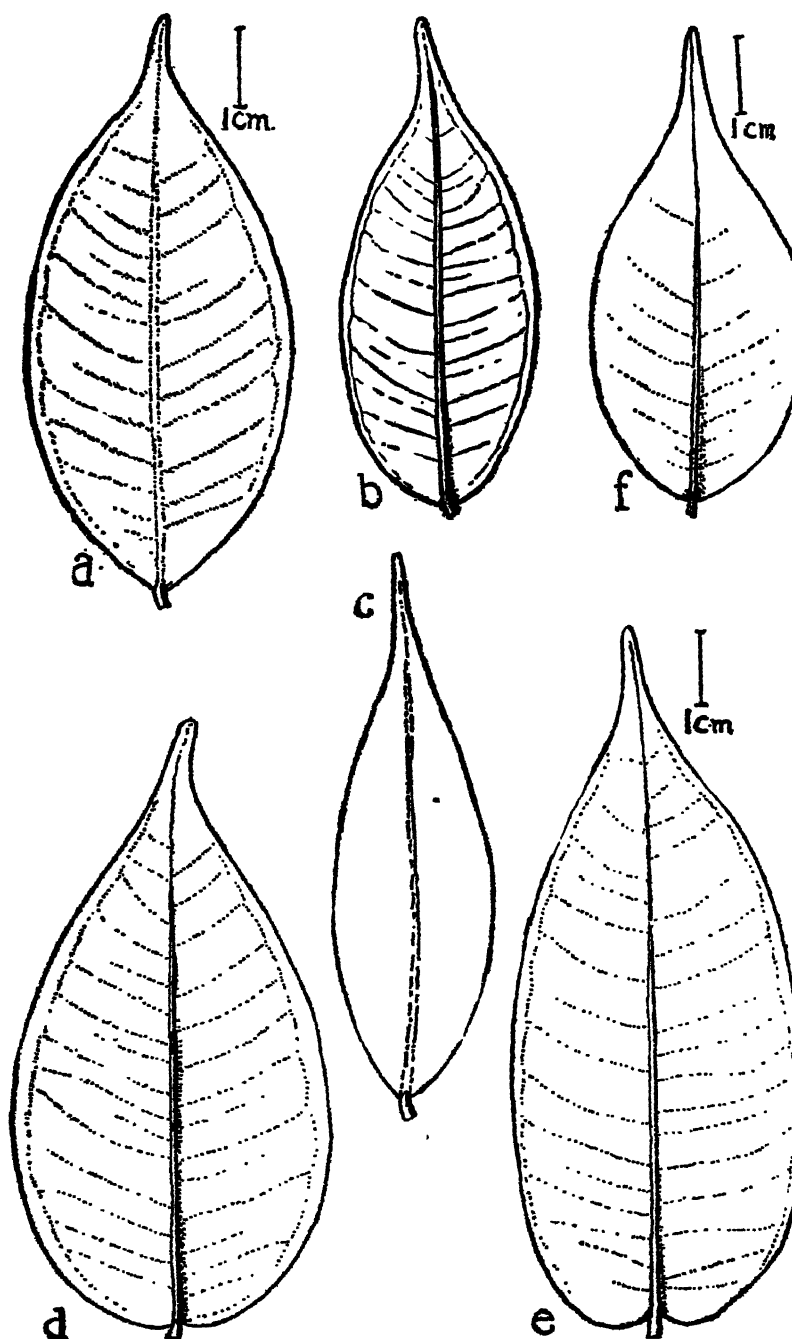


Fig. 43. a, b, c, *E. polita*; d, e, *E. tecta*; f, *E. jasminifolia*.

NEGRI SEMBILAN: Gunong Tampin, *Ridley* s.n.; Gemas. SFN 4976 (*Burkill*); Ulu Rembau, SFN 11775 (*Nur*).

PAHANG: Bukit Kajang, Raub, Forest Dept. FMS 20495; Ulu Serau, Forest Dept. FMS 25233, 25335.

*Distrib*: Endemic.

A small bushy tree. *Twigs* very slender, the youngest acutely or obtusely 4-angled, older ones terete, drying smooth and pale brown. *Leaves* thinly coriaceous, lanceolate to ovate lanceolate, apex acuminate or caudate acuminate, base cuneate or narrowed and minutely rounded, from c. 2.5 cm.  $\times$  1 cm. to c. 6 cm.  $\times$  2.5 cm., both surfaces drying pale brown to reddish brown, the upper darker, polished and punctate, lower dull, with scattered black dots; midrib impressed above, elevate below, with distant pustulations; *primary nerves* about 10 pairs, usually very faint or invisible on both surfaces, occasionally slightly raised below; petiole drying black and wrinkled, up to c. 4 mm. long but usually shorter.

*Flowers* sessile in dense axillary and terminal sessile heads c. 1 cm. across, with numerous narrowly oblong acute papery keeled bracts longer than the flowers, dropping after the flowers open; *calyx* narrowly funnel shaped, c. 6 mm. long and 3-4 mm. across mouth after anthesis, longitudinally wrinkled, gradually narrowed to base and there contracted into a short pseudostalk 0.5-1 mm. long; lobes 5, persistent, erect, glandular pustulate, ovate triangular, c. 1.5 mm. across and 1.5 mm. tall; *petals* free (?falling as a calyptra), orbicular, conspicuously glandular pustulate, c. 1.2 mm. diam.; *stamens* numerous, filaments slender, flattened, up to c. 7 mm. long, anthers elliptic oblong, c. 0.4 mm. long, connective gland distinct; *style* stout, terete, c. 9 mm. long; *ovary* 2-celled.

*Fruit* globular, greenish or white when ripe, c. 8 mm. diam., smooth, minutely and closely glandular, apical umbilicus shallow, c. 3 mm. diam., fringed by the erect calyx lobes; pericarp thin; seed 1, globose or somewhat reniform, testa rather papery, adhering closely to the smooth conspicuously gland pitted surface of the cotyledons; inner faces conspicuously gland dotted, excavate and folded, the hypocotyle large, quadrangular, gland dotted, almost concealed in a fold of one cotyledon, reaching periphery of seed and there expanded and truncate.

The four preceding species, *E. tetraptera*, *E. polita*, *E. tecta* and *E. jasminifolia* form a group of closely related species which tend to overlap in a confusing manner. Of none of them is there abundant material and further collections may show that too many species have been made.

They may be distinguished as follows:—

Bracts conspicuous, as long as flowers:

Flowers in sessile heads:

Leaves more or less nerveless, narrowed to base  
*jasminifolia*.

Leaves with raised nerves below, bases rounded,  
usually more or less cordate  
*tetraptera* var. *pseudotetraptera*.

Flowers in condensed panicles:

Leaves lanceolate, usually narrowed to base  
*polita*.

Leaves with broad, rounded, more or less cordate  
bases  
*tetraptera* var. *pseudotetraptera*.

Bracts small or absent:

Leaves with very faint nerves, midrib below very  
slightly tuberculate or smooth  
*tecta*.

Leaves with conspicuous raised nerves below, midrib  
conspicuously tuberculate  
*tetraptera*.

The flowers of the four species are all of the same type, having a narrowly funnel shaped calyx with persistent lobes, but those of *E. tecta* are larger than those of the other three.

The following collection, which belongs in this group, has not been placed. It appears to connect *E. jasminifolia* with *E. tecta*. It has a sessile bracteate inflorescence but the flowers are larger than in *jasminifolia* and approach those of *tecta*. The leaves are thicker and larger than those of *jasminifolia*, rounded and minutely cordate at base, without black dots:—

JOHORE: Gunong Belumut, 3,000 ft., *SFN* 10820 (*Holttum*).

119. *Eugenia nitidula* Ridl., F.M.P., V (Suppl.) 308 (1925). (Fig. 44a, b).

PERAK: Gunong Inas, 5,000 feet, *Way* 4114, 4115.

PAHANG: Fraser Hill, 4,000 feet, *SFN* 8677 (*Burkill & Holttum*), type collection; Cameron Highlands, c. 5,000 feet, *SFN* 13039 (*Henderson & Whitty*); Jasar, Cameron Highlands, Forest Dept. *FMS* 27309; Gunong Berumban, Cameron Highlands, Forest Dept. *FMS* 31010; Gunong Lesong, Kuantan, Forest Dept. *FMS* 4157.

*Distrib:* Endemic.

A bush or bushy tree up to c. 15 m. tall; bark entire, rather rough and bumpy, reddish or greyish brown. Twigs slender, the youngest acutely 4-angled, bark drying smooth and pale brown, older ones obtusely 4-angled or terete with slightly flaky dark brown bark. Leaves small, stiff, thickly coriaceous, elliptic lanceolate to ovate lanceolate, or almost

ovate, apex more or less acuminate, base broadly cuneate or rounded, from c. 2 cm.  $\times$  0.75 cm. or even smaller to c. 3.5 cm.  $\times$  2 cm., upper surface drying leaden brown to dark reddish brown, shining, sparsely and minutely punctate or black dotted, lower surface pale reddish brown, dull; midrib impressed above, elevate below; *primary nerves* about 10 pairs, slightly raised and very faint or invisible above, raised below but usually not very distinct, joining an obscure intramarginal nerve close to the recurved leaf margin; reticulations when visible almost as distinct as primaries; petiole up to c. 3 mm. long but often less than 1 mm., drying black and wrinkled.

*Flowers* sessile in terminal and axillary small rather few flowered bracteate tufts, bracts numerous, persistent, lanceolate acuminate to linear oblong; *calyx* cylindric funnel shaped, slightly ribbed and obscurely pustulate, c. 4.5 mm. long and 2.5 mm. across mouth, tapered slightly at base into an exceedingly short and obscure pseudostalk; lobes 4, persistent, spreading-erect after anthesis, broadly ovate rounded, c. 1.3 mm. across and a little more than 1 mm. tall; *petals* calyptrate; *stamens* numerous, filaments slender, c. 2-3 mm. long, anthers elliptic ovate, c. 0.2 mm. long, connective gland distinct; *style* stouter than filaments, terete, c. 8 mm. long; *ovary* 2-celled.

This species is closely allied to *E. bankensis* (Hassk.) Backer (*Syzygium bankense* (Hassk.) Merr. and Perry), but differs in the larger, acuminate leaves, the less crowded flowers with less glaucous calyces and in being a mountain, not a lowland plant.

120. ***Eugenia clypeolata*** Ridl. in Journ. Roy. As. Soc. Str. Br., LXXXII, 185 (1920); F.M.P., I, 754. (Fig. 44c).

PAHANG: Slopes beyond Teku river, Gunong Tahan, Ridley 16022 (type collection).

*Distrib.*: Endemic.

A *bush*, youngest *twigs* slender, acutely 4-angled, smooth, bark drying pale brown, older twigs stout, terete, with slightly flaky greyish or brownish bark. *Leaves* very stiff and coriaceous, crowded, ovate or elliptic ovate, slightly narrowed to the blunt or retuse apex, base rounded and minutely cordate, c. 2 cm.  $\times$  1.5 cm., upper surface somewhat polished, drying olivaceous brown to blackish brown above, lower surface dull, reddish brown; midrib narrowly impressed above, slightly elevate or almost flat below; *primary nerves* about 8 pairs, very obscure on both surfaces or almost invisible, slightly impressed above, very slightly raised below, the intramarginal nerve sometimes more

distinctly impressed above than the rest of the venation, usually very obscure below; petiole very short and stout, c. 2 mm. long, transversely wrinkled.

*Panicles* terminal, usually more or less hidden by the leaves, not more than about 1.5 cm. long, densely flowered, the rachis and one pair of very short, stout branches acutely 4-angled with pale yellowish brown bark; *flowers* sessile, in threes or clusters at ends of branches; *calyx* cylindric funnel shaped, c. 5 mm. long and 2.5–3 mm. across mouth, tapering slightly to base and there contracted into a pseudostalk of varying length, from almost none to c. 15 mm., tube ribbed, obscurely and minutely pustulate especially towards apex; lobes 5, persistent, erect-spreading, broad and rounded, distinctly glandular pustulate, c. 1.5 mm. across and 1 mm. tall, margins thin; *petals* falling in a hemispherical calyptra c. 3 mm. diam.; *stamens* numerous, filaments slender, up to c. 4 mm. long, anthers broadly oblong, 0.4–0.5 mm. long, connective gland distinct; *style* much stouter than filaments, subulate, 4–5 mm. long; *ovary* 2-celled.

Known only from one collection. Differs from *E. Stapfiana* in the broader leaves and the much less distinctly pustulate calyx tube.

121. *Eugenia Stapfiana* King, Mat. F.M.P., No. 12, 119 (1901); Ridl., F.M.P., I, 753. (Fig. 44d, e).

TRENGGANU: Gunong Padang, 4,000 feet, SFN 31080 (*Moysey & Kiah*).

KELANTAN: Gunong Sitong, 6,000 feet, *Jupe s.n.*, Forest Dept. FMS 37696.

PERAK: Wray's Berumban, c. 7,000 feet, *Wray 1532* (syntype); Gunong Batu Puteh, 4,500 feet, *Wray 216, 1619* (syntypes); Gunong Korbu, 4,500 feet, *Robinson s.n.*, 5,500–7,000 feet, Forest Dept. FMS 32103, 32215; sine loc., *Scortechini 336* (syntype).

SELANGOR: Ulu Semangkok, *Ridley 12104*; Gunong Ulu Kali, 5,812 feet, Forest Dept. FMS 343.

PAHANG: Gunong Tahan, 6,000 feet, *Corner s.n.*; Cameron Highlands, 4,000 feet, FMS Mus. 11696 (*Henderson*); Gunong Irau, summit, Forest Dept. FMS 36564; Pinetree Hill, Fraser Hill, *Corner s.n.*, Forest Dept. FMS 29488; Gunong Tapis, Kuantan, 4,600 feet, SFN 28846 (*Symington & Kiah*).

*Distrib.*: Endemic.

A shrub or small tree up to c. 8 m. tall; bark smooth, not flaky, brownish grey, fuscous. Youngest twigs slender, acutely 4-angled with smooth brown bark when dry, older ones obtusely 4-angled or terete with greyish or brownish more or less flaky bark. Leaves small, thickly coriaceous.

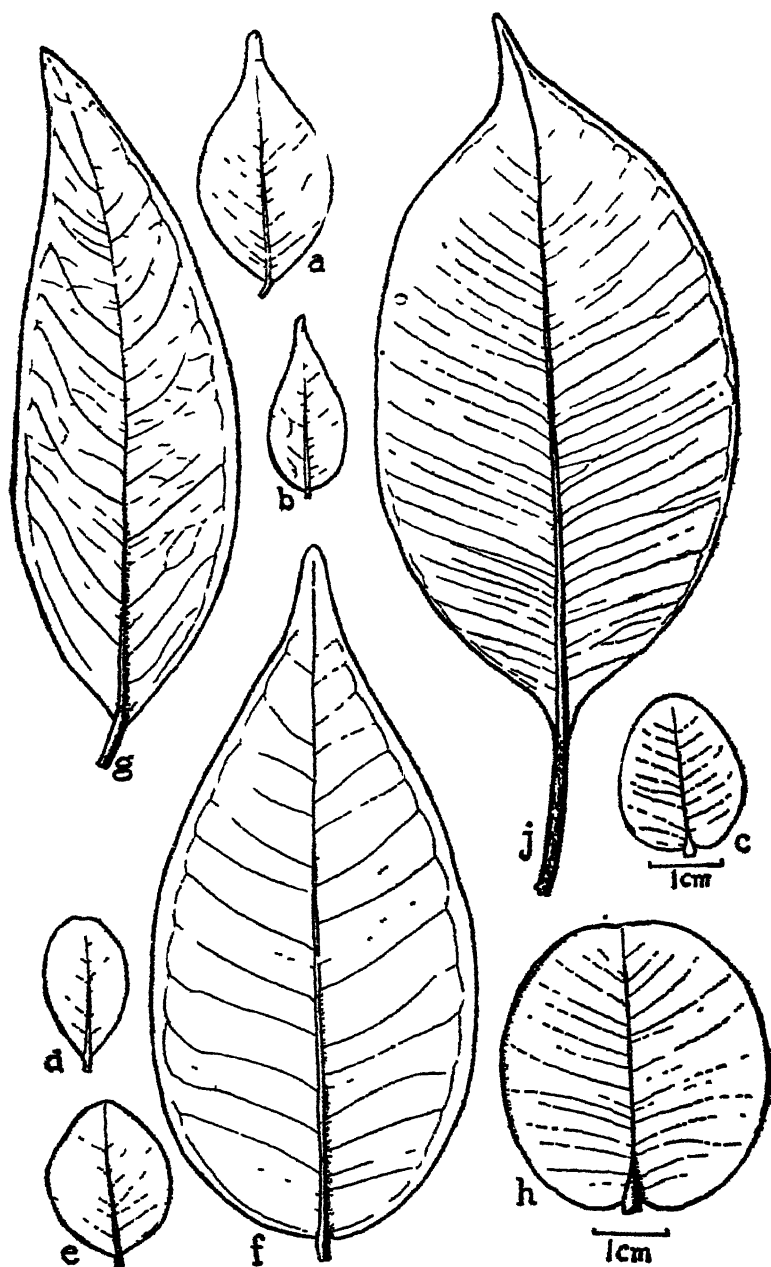


Fig. 44. a, b, *E. nitidula*; c, *E. clypeolata*; d, e, *E. Stapfiana*; f, *E. spicata*; g, *E. grata*; h, *E. spissifolia*; j, *E. leucorhylon*.

rigid, broadly lanceolate to elliptic or ovate, tapering to the broad blunt subacute or rounded and sometimes retuse apex, base broadly cuneate or rounded, from c. 1.5 cm. to 2 cm. long and 0.75 cm. to 1.5 cm. broad; upper surface drying olivaceous brown to blackish brown, shining, more or less scattered-punctate, lower surface reddish brown, dull; midrib impressed above, flat or slightly elevate below; *primary nerves* 7-8 pairs, usually almost or quite invisible above, sometimes slightly raised below and faint, or invisible; leaf margin recurved; petiole stout, very short, drying black and wrinkled, usually less than 3 mm. long.

*Panicles* terminal, short, scarcely exceeding the leaves, rather densely flowered, the short branches stout, 4-angled with conspicuous wavy wings; *flowers* sessile or very shortly and stoutly pedicellate, subtended by small subsistent bracteoles; *calyx* narrowly funnel shaped or narrowly campanulate after anthesis, 5-6 mm. long, 2.5-3 mm. across mouth, gradually tapered to base and contracted into a short pseudostalk up to c. 1.5 mm. long, longitudinally ribbed and conspicuously coarsely pustulate; lobes 5, erect, persistent, broadly ovate rounded, thick textured with thin margins, 1.5-2 mm. across and c. 1 mm. tall; *petals* falling as a calyptra, partially agglutinated or free, orbicular, sparsely gland dotted, c. 2.5 mm. diam.; *stamens* numerous, filaments slender, up to c. 8 mm. long, anthers ovate, c. 0.5 mm. long, connective gland conspicuous; *style* stout, subulate, 5-6 mm. long; *ovary* 2-celled.

*Fruit* white, globular, c. 5 mm. diam., wrinkled and glandular pustulate when dry, apex crowned by the short wide calyx rim c. 3 mm. diam., bearing the erect enlarged calyx lobes; seed 1, somewhat reniform, surfaces of cotyledons smooth and pitted; cotyledons nearly equal, inner faces folded and excavate, attached near the periphery to the large quadrangular gland dotted hypocotyle which reaches the surface of seed.

A common species on the summits and ridge tops of the higher hills which I believe to be closely related to *E. spicata* var. *tenuiramis*, of which it might even be considered an extreme form. It differs, however, in the much shorter thicker leaves not caudate acuminate, and in the shorter inflorescences and shorter pseudostalk. The shape of the calyx tube is very close to that of *E. spicata* and it has similar pustulations. Another ally is *E. kinabaluensis* Stapf from Mt. Kinabalu in Borneo, which has more rotund retuse leaves and a smooth calyx tube. *E. nitidula* Ridl. is also very similar, but this has acuminate leaves and a smooth calyx tube.

122. *Eugenia spicata* Lamk., *Encycl. Bot.*, III, 201 (1789); Corner, *Wayside Trees of Malaya*, p. 503, pl. 154. *Myrtus zeylanica* Linn., *Sp. Pl.*, 472 (1753). *Syzygium zeylanicum* (L.) DC., *Prodr.*, III, 260 (1828); Merr. & Perry in *Journ. Arn. Arb.*, XIX, 101, 224; Mem. Amer. Acad. Arts & Sci., XVIII, 3, 159. *Eugenia zeylanica* Wight, Ill., II, 15 (1841); Duthie in Hook. fl., F.B.I., II, 485; King, *Mat. F.M.P.*, No. 12, 108; Ridl., *F.M.P.*, I, 738; non Willd. (1800). (Fig. 44f).

Common in the lowlands from Kedah and Trengganu to Singapore, usually by seashores and rivers but also in forest and secondary growth.

*Distrib.*: India, Ceylon, Burma, Indo-China, China, Siam, Malaysia.

A bush or small straggly tree reaching c. 9 m. tall; bark thinly papery flaky, rufous orange, inner bark very thin, pale fawn. *Twigs* slender, obscurely 4-angled or terete with pale brown or greyish or reddish brown bark. *Leaves* coriaceous, lanceolate, elliptic lanceolate or ovate lanceolate, apex bluntly or acutely acuminate, base broadly cuneate or rounded, from c. 4 cm. to 9 cm. long and 1.5 cm. to 4 cm. broad; upper surface shining, drying brown to dark reddish brown, black dotted or punctate, lower surface paler and duller with minute scattered darker glands; midrib impressed above, slightly elevate or flat below; *primary nerves* 10-14 pairs, 2-4 mm. apart, usually finely impressed above and faint or almost invisible, very fine and raised below, distinct or obscure, curving up rather irregularly to a fine intramarginal nerve 1-1.5 mm. from leaf margin; secondaries and reticulations rather faint and obscure; petiole short, slender, drying black, up to c. 4 mm. long.

*Panicles* terminal and axillary, crowded, the axillary ones usually shorter than the leaves, the terminal ones often longer, branches and rachis slender, 4-angled, drying pale, the branches short or long, sometimes none; *flowers* faintly fragrant, white, sessile in threes or clusters on the rachis, at the ends of the branches, or at ends of the very short ultimate branchlets; *calyx* cylindric-funnel-shaped, c. 6 mm. long and 2-2.5 mm. across mouth, conspicuously and coarsely pustulate, constricted at base into a slender pseudo-stalk reaching c. 4 mm. long; lobes 5, erect, persistent, broadly ovate rounded, a little less than 1 mm. tall; *petals* falling in a hemispherical calyptra c. 2.5 mm. diam., sparsely gland dotted; *stamens* numerous, filaments slender, up to c. 8 mm. long, anthers oblong elliptic, c. 0.4 mm. long connective gland conspicuous; *style* stouter than filaments, c. 8 mm. long; *ovary* 2-celled.

*Fruit* oblong or oblong globose, white, c. 5–7 mm. long, apex deeply and narrowly excavate, with the erect or incurved calyx lobes; pericarp pithy, sweet; seed 1, greenish, cotyledons nearly equal, inner faces folded and excavate, the hypocotyle large, reaching periphery of seed.

*E. spicata* Lamk. var. *tenuiramis* (Miq.) var. nov.

*Jambosa tenuiramis* Miq., Fl. Ind. Bat. I, i, 437 (1855), loc. cit., Suppl. I, 311. *Eugenia longicauda* Ridl. in Journ. Roy. As. Soc. Str. Br., LXI, 7 (1912); F.M.P., I, 752. *E. nitidissima* Merr. in Philipp. Journ. Sci., X, 213 (1915).

PAHANG: Kluang Terbang, Gunong Benom, 5,000 feet, *Barnes 10869* (type collection of *E. longicauda* Ridl.).

JOHORE: Gunong Belumut, 2,500 feet, *SFN 10790* (*Holttum*), leaf specimens only; Gunong Panti, in ridge forest on summit, 1,600 feet, *Corner s.n.*, *SFN 32217* (*Corner*), *Forest Dept. FMS 35755*.

*Distrib*: Sumatra, Philippines.

I have seen several sheets, preserved in Herb. Calcutta, of Teysmann's collection from Sumatra, "ad littora Siboga", which is quoted by Miquel. These match very closely the type of *E. longicauda* Ridl., and also the type of *E. nitidissima* Merr., the latter differing only in the paler and rather broader leaves and in the strongly angled youngest shoots. These angled shoots are present in only one of the Malay Peninsular collections, but it seems probable that the very young shoots quickly lose their angles and become terete. *SFN 10790* from Gunong Belumut is sterile but otherwise a close match for Teysmann's specimens.

The variety differs from the typical form only in the narrower, longer, long caudate-acuminate leaves, which are usually thicker in texture. There is a very considerable range of variation in size and shape of leaves in the typical form and narrow long caudate leaves are often found along with the normal broader blunter leaves on the same individual. The variety appears never to have the broad leaves of the typical form.

King has written up the sheets of Teysmann's collection in Herb. Calcutta as *E. zeylanica* Wight. There may be no justification for maintaining the variety, but it looks very different and in Malaya at least has a different habitat from the typical form.

The type of *Jambosa tenuiramis* Miq., which I have not seen, came from "Onder-Tapanoei", Sumatra, and in Miquel there is no indication at what altitude above sealevel it was collected. Teysmann's collection from Siboga is from the coast, and this is the normal habitat of *E. spicata*. All the

Malayan collections and the Philippine collection of the variety come from forested ridges from about 1,000 feet upwards.

True *E. spicata* is not recorded from the Philippines, but it is common in Borneo. Its nearest ally in the Philippines appears to be *E. glaucicalyx* Merr. C. B. Robinson in Philipp. Journ. Sci., IV, 382 hints that this may not be separable from *E. spicata*, but the few specimens I have seen of it show a smooth, glaucous, not pustulate calyx tube, which would place it nearer *E. grata* Wight.

123. *Eugenia grata* Wight, Ill., II, 15 (1841); Duthie in Hook. fil., F.B.I., II, 486; King, Mat. F.M.P., No. 12, 109; Ridl., F.M.P., I, 739; Craib, Fl. Siam. Enum., I, 644; Corner, Wayside Trees of Malaya, p. 498. (Fig. 44g).

Common on rocky and sandy seashores from Kedah and Trengganu to Johore, commonest in the north of the Peninsula, but found also in the wet forests of S.E. Johore.

*Distrib.*: Assam, Burma, Siam, Sumatra, ? Borneo, ? Philippines.

Usually a small *tree* but reaching c. 18 m. tall, trunk sometimes slightly stilt rooted at base; bark coarsely papery flaky, reddish brown or orange brown. *Twigs* slender, terete or obscurely 4-angled, bark drying pale brown or brown, somewhat flaky in older twigs. *Leaves* coriaceous, lanceolate to ovate lanceolate, apex acuminate, base cuneate, from c. 3–11 cm. long and 1.5–5.5 cm. broad, usually c. 7–10 cm.  $\times$  2–3.5 cm., upper surface shining, drying pale brown to blackish brown, often sparsely punctate, lower surface duller and paler, often subglaucous, sometimes sparsely black dotted; midrib impressed above, more or less elevate below; *primary nerves* about 12 pairs, usually less than 0.5 cm. apart, somewhat irregular, obliquely ascending and curving up to a nearly straight intramarginal nerve 2–3 mm. from leaf margin, slightly impressed or slightly raised above, faint or very faint, usually slightly elevate and distinct below, sometimes faint, secondaries and reticulations when visible less distinct than primaries; petiole rather slender, channelled above, transversely wrinkled, c. 0.5 cm. long.

*Inflorescence* as in *E. spicata*; *flowers* white, sessile; *calyx* narrowly cylindric funnelshaped, c. 6 mm. long and 2–2.5 mm. across mouth, wrinkled and glaucous, rather obscurely glandular pustulate, contracted at base into a distinct pseudostalk 1–2 mm. long; lobes 5, erect, persistent, broadly ovate rounded or ovate triangular, c. 1–1.3 mm. across and c. 1 mm. tall; *petals* probably falling as a calyptra, free or partially agglutinated, orbicular, gland

dotted, c. 1.5–2 mm. diam.; *stamens* numerous, filaments slender, reaching c. 8 mm. long, anthers elliptic oblong, c. 0.4 mm. long, connective gland distinct; *style* much stouter than filaments, terete, c. 10 mm. long; *ovary* 2-celled.

It seems probable that *E. grata* Wight is *Caryophyllus antisepticus* Bl. in DC., Prodr., III, 262 (1828); *Syzygium antisepticum* (Bl.) Merr. and Perry in Mem. Amer. Acad. Arts and Sci., XVIII, 3, 159 (1939); and that *Eugenia glaucalyx* Merr. in Philipp. Gov. Lab. Bur. Bull., XXXV, 50, should be reduced to it, giving the species a range from Assam to the Philippines through Burma, Siam, Sumatra and Borneo, with a possible extension to China.

Unfortunately I have not seen any authentic material of *E. grata*, and of the material quoted as Bornean of *S. antisepticum* only a poor sheet of *E. cuprea* Koord. and Valet. has been available. This might easily be called *E. grata*. Merrill and Perry mention *Kunstler 5414* as being very close to *S. antisepticum*, except that the leaves are smaller. This collection has smaller and more cuspidate leaves than the bulk of the Malayan collections placed with *E. grata*, but there is a great range of variation in the shape, size and venation of the leaves in these collections.

In view of the fact that I have not been able to check the reductions made by Merrill and Perry and because the name *E. grata* is used for this species in most recent works, I prefer to leave it there in the meantime.

There is one puzzling point regarding the fruit. Duthie and King describe it as black and King makes this one of the characters separating *E. grata* from *E. spicata*, which has a white fruit. Craib, who apparently does not consider the Malayan plant to be *grata*, mentions the dark fruit of *grata* in connection with a variety of this species which he describes and which has a white fruit. *E. glaucalyx* Merr. is described as having a white fruit. Corner, who has seen living fruit of the Malayan plant, describes it in *Wayside Trees of Malaya* as white or greenish white. The descriptions of *Caryophyllus antisepticus* do not mention fruit. These discrepancies may indicate that *E. grata* Wight is not the Malayan plant, and that we have another very closely related species taking its place, which may or may not be Blume's species. Whatever our plant may be it is closely related to *E. spicata* Lamk. but can be distinguished at once by its glaucous wrinkled calyx tube without pustulations, with usually a shorter pseudostalk.

124. *Eugenia spissifolia* Ridl. in Journ. F.M.S. Mus., V, 32 (1913-14); F.M.P., I, 753. (Fig. 44h).

SELANGOR: Gunong Mengkuang, 5,000 feet, *Robinson s.n.* (type collection).

A shrub. Twigs 4-angled, drying dark brown or almost black, with finely wrinkled bark. Leaves very coriaceous, stiff, orbicular, or broadly elliptic, or broadly oblong elliptic, apex round, base rounded and slightly cordate, up to c. 4 cm. long and 4 cm. broad; both surfaces drying yellowish, the upper polished and minutely punctate, the lower dull, somewhat rugulose and sparsely and minutely black dotted; midrib slightly channelled above, raised below and more or less keeled; primary nerves about 10 pairs, spreading, almost or quite invisible above, slightly raised and faint below, a very faint intramarginal nerve sometimes just visible close to the thickened and recurved leaf margin; secondaries below somewhat fainter than primaries, reticulations seldom visible; petiole very short, broad, transversely wrinkled, the leaves appearing sessile.

Panicles terminal, up to c. 2-3 cm. long, rachis and short branches 4-angled; flowers sessile; calyx narrowly funnel shaped, 9-10 mm. long, somewhat swollen at apex and gradually narrowed to base, wrinkled and obscurely pustulate; lobes 5, one much larger than the others and subpetaloid, the 4 smaller ones broadly ovate rounded, c. 1 mm. across and 0.5 mm. tall, the large one thin, broadly ovate orbicular, c. 1.5-2 mm. diam.; petals not seen; stamens numerous, short, reaching c. 1.3 mm. long, filaments stout, tapering upwards, anthers broadly ovate elliptic, c. 0.4 mm. long, connective gland none; style stout, 3-4 mm. long.

Known only from one collection but a distinct species in its very thick small round leaves and the long flowers with short stamens.

125. *Eugenia leucoxydon* (Korth.) Miq., Anal. Bot. Ind., I, 26, tab. 9 (1850). *Syzygium leucoxydon* Korth., Nederl. Kruidk. Arch., I, 203 (1847); Miq., Fl. Ind. Bat., I, i, 454; Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 193. *Syzygium verecundum* Wall. Cat. nom. nud. *Eugenia verecunda* Duthie in Hook. fil., F.B.I., II, 496 (1878); King, Mat. F.M.P. No. 12, 125; Ridl., F.M.P., I, 748, incl. var. *major* Ridl. in Journ. Bot., LXVIII, 33 (1930); Corner, Wayside Trees of Malaya, p. 504. (Fig. 44j).

TRENGGANU: Kemaman river mouth, Forest Dept. FMS 26994.

PENANG: sine loc., *Phillips s.n.*, *Wallich 3579*.

PERAK: sine loc., *Scortechini s.n.*; Pulau Lallang, *Seimund s.n.*; Pulau Rumpia, *Kloss s.n.*

DINDINGS: Pangkor, *Scortechini* 103, 137, 957, *SFN* 31651 (Corner).

NEGRI SEMBILAN: Pasir Panjang, *Forest Dept. FMS* 596.

PAHANG: Kuantan mangrove, *Forest Dept. FMS* 15607.

JOHORE: Pinerong, *Cantley s.n.*; Kangka Sedili Ketchil, *SFN* 28557 (Corner).

SINGAPORE: Pulau Ubin, *Ridley* 9486.

*Distrib*: Anamba Islands; Borneo; Philippines (*vide* Merrill & Perry).

A tree reaching c. 15 m. tall; bark entire, very smooth with persistent leaf scars, or rather scaly, uneven and bumpy, slightly flaky fissured when old, light grey or buff grey; inner bark brownish or purplish brown with green layer below surface. *Twigs* slender, terete, bark drying pale yellowish, smooth or becoming flaky. *Leaves* thinly coriaceous, ovate, or elliptic, or oblong elliptic, apex acuminate, base broadly cuneate, from c. 5 cm.  $\times$  2.5 cm. to 10 cm.  $\times$  5 cm.; upper surface shining, drying pale brown or greenish brown to reddish brown, very minutely punctate, lower surface paler, dull, minutely black dotted; midrib impressed above, elevate below; *primary nerves* numerous and close together, meeting an intramarginal nerve c. 1 mm. from leaf margin, very fine and slightly raised on both surfaces, slightly more evident above, reticulations numerous, almost as distinct as primaries; petiole slender, reaching 1.5–2 cm. long.

*Panicles* terminal or from upper axils, clustered, up to c. 9 cm. long, peduncle and branches slender, 4-angled with rather dark striate bark when dry; *flowers* small, in threes or twos or solitary at the ends of the short slender 4-angled ultimate branchlets, pedicelled or sessile, the two outer flowers of the triads often pedicelled and the centre one sessile; *calyx* 2.5–3 mm. long, c. 1 mm across mouth before anthesis, constricted below the globose turbinate apex into a rather slender ribbed pseudostalk 1.5–2 mm. long; mouth with 4 distant, small but rather conspicuous, erect, broadly ovate rounded or acute lobes; *petals* agglutinated into a thick calyptra c. 1.2 mm. diam. (separable, *vide* Miquel); *stamens* numerous, filaments stout, up to c. 0.5 mm. long, anthers ovate, 0.2–0.3 mm. long, connective gland small; *style* stout, c. 0.5–1 mm. long; *ovary* 2-celled.

*Fruit* ripening white suffused rose purple, more or less ellipsoid to oblong ellipsoid, or nearly globose, somewhat compressed, slightly oblique, c. 6–7 mm. long and 5–6 mm. diam., smooth or faintly vertically ridged, apical umbilicus shallow, c. 2 mm. diam., the calyx rim usually rather prominent, 0.5–0.75 mm. tall, with obscure remains of calyx lobes and style base; cotyledons nearly equal, side by side, sessile or very shortly stalked, inner faces conspicuously gland dotted, slightly excavate.

A well marked species with its pale twigs, rather thin, closely nerved acuminate leaves with long petioles, and very small flowers.

Although I have not seen Korthal's type, nor any of the material quoted by Merrill and Perry, Korthal's description and Miquel's descriptions and figure fit our plant. I have seen no authentic material of the Philippine *E. brevistylis* C. B. Rob. which Merrill and Perry reduce to *S. leucoxydon*.

There seems to be some confusion in Ridley's Flora over this species. He gives the habitat as "hill woods to 2,000 ft. altitude" apparently on the basis of specimens from Penang of his own collecting ("Penara Bukit; Hill 2,000 ft. altitude") which I have not been able to trace. All the other collections for which data are available come from low altitudes, and the habitat of the species seems to be seashores and tidal rivers.

126. *Eugenia flosculifera* Henderson in Gardens' Bulletin, Singapore, XI, 329, fig. 15 (1947).

SINGAPORE: Reservoir Jungle, *SFN 36133* (Corner).

*Distrib*: Endemic. Specimens collected at Bukit Kajang, Kemaman, *SFN 30481* (Corner), may also belong here.

A tree c. 40 m. tall with steep narrow buttresses to c. 2 m.; crown large, spreading; bark light buff, slightly scaly flaky, smooth over large areas, slightly pustulate with lenticels, otherwise entire; inner bark thick, pale brownish yellow with fine longitudinal sclerotic strands; wood pale brownish buff. Twigs rather slender, terete, smooth, pale whitey grey to very pale yellowish, somewhat polished, youngest shoots often angled or channelled. Leaves thinly coriaceous, usually obovate, sometimes elliptic or oblong elliptic, up to c. 7 cm.  $\times$  3.5 cm. but usually smaller, apex abruptly acuminate, acumen up to 1 cm. long, base long narrowed and decurrent on petiole; upper surface dull olivaceous brown or blackish brown when dry, lower surface paler brown or yellowish brown, with sparse brownish gland dots; midrib sunk above, raised below; primary nerves up to c. 8 pairs, often fewer, 5-8 mm. distant, slightly raised above or hardly visible, fine and raised below, meeting in an intramarginal nerve c. 3 mm. from leaf margin; secondaries and reticulations invisible above, less conspicuous than primaries below, reticulations lax; petiole up to c. 1 cm. long, often finely glandular pustulate.

Panicles terminal or from upper axils, the terminal ones often fasciculate, up to c. 9 cm. long but usually shorter, primary branchlets ascending, up to c. 2 cm. long, secondary branchlets 5-7 mm. long, both slender with brown striate bark; flowers small, sessile, usually in threes, sometimes in

pairs at branchlet ends; buds c. 3 mm. long; *calyx* c. 2.5 mm. long, c. 1.75 mm. across lobes, tube more or less fusiform, suddenly contracted below lobes, swollen about ovary, then gradually narrowed to a pseudostalk c. 1 mm. long; lobes 4, broadly triangular, blunt or subacute, incurved, c. 0.5 mm. high and 1 mm. wide; *petals* calyptrate; *stamens* about 16 in a single row on edge of disc, 0.5–1 mm. long, filaments stout, the upper part remaining sharply bent inwards until long after the flower opens, anthers 0.2–0.3 mm. long, connective gland conspicuous; *style* c. 0.5 mm. long; *ovary* 2-celled with few ovules in each cell.

*Fruit* pale shining green, broadly oblong to oblong obovoid, up to c. 1.5 cm. long and 1.5–1.75 cm. wide, apex depressed, with a conical excavation 4–5 mm. diam., fringed with the minute calyx rim; pericarp firm, green, slightly juicy, c. 5 mm. thick; seed 1, globose or somewhat depressed globose or obovoid, testa thin, papery, loose, pale brown, cotyledons dark blackish brown, completely fused, without visible commissure, taking the form of a hollow ball when fully ripe.

This very peculiar species is readily distinguished from all others in Malaya by its large size, its small leaves, its very small flowers with few stamens and its unusual seed; and it should perhaps be placed in a new section of the genus.

It is a striking commentary on the incompleteness of our knowledge of the flora of this region that this species, and others enumerated in this paper, should have remained undetected for so long in Singapore Island, large and conspicuous trees though they are. One can only surmise how many species may have been obliterated without becoming known to science when at this late date, when the original forest has been reduced to a few remnants, at least three species in one genus alone are found to be new, and several others have never before been collected on the island.

127. *Eugenia attenuata* (Miq.) Koord. and Valet. in Meded. Lands Plantent., XL, 121 (1900); Atlas Baumart. Java, III, fig. 490. *Jambosa attenuata* Miq., Fl. Ind. Bat., I, i, 437 (1855). *Syzygium attenuatum* (Miq.) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 185 (1939). *Eugenia penangiana* Duthie in Hook. fil., F.B.I., II, 486 (1878); King, Mat. F.M.P., No. 12, 98, pro parte; Ridl., F.M.P., I, 740, pro parte; Corner, Wayside Trees of Malaya, p. 501, fig. 168. (Fig. 45a, b).

KEDAH: Kedah Peak, c. 3,500 feet, *SFN 14849* (Holttum).

PENANG: Government Hill, 500 feet, *Curtis 193*; Waterfall, *Curtis 2972*; sine loc., 800 feet, *Kunstler 1368*.

PERAK: sine loc., *Scortechini 132*.

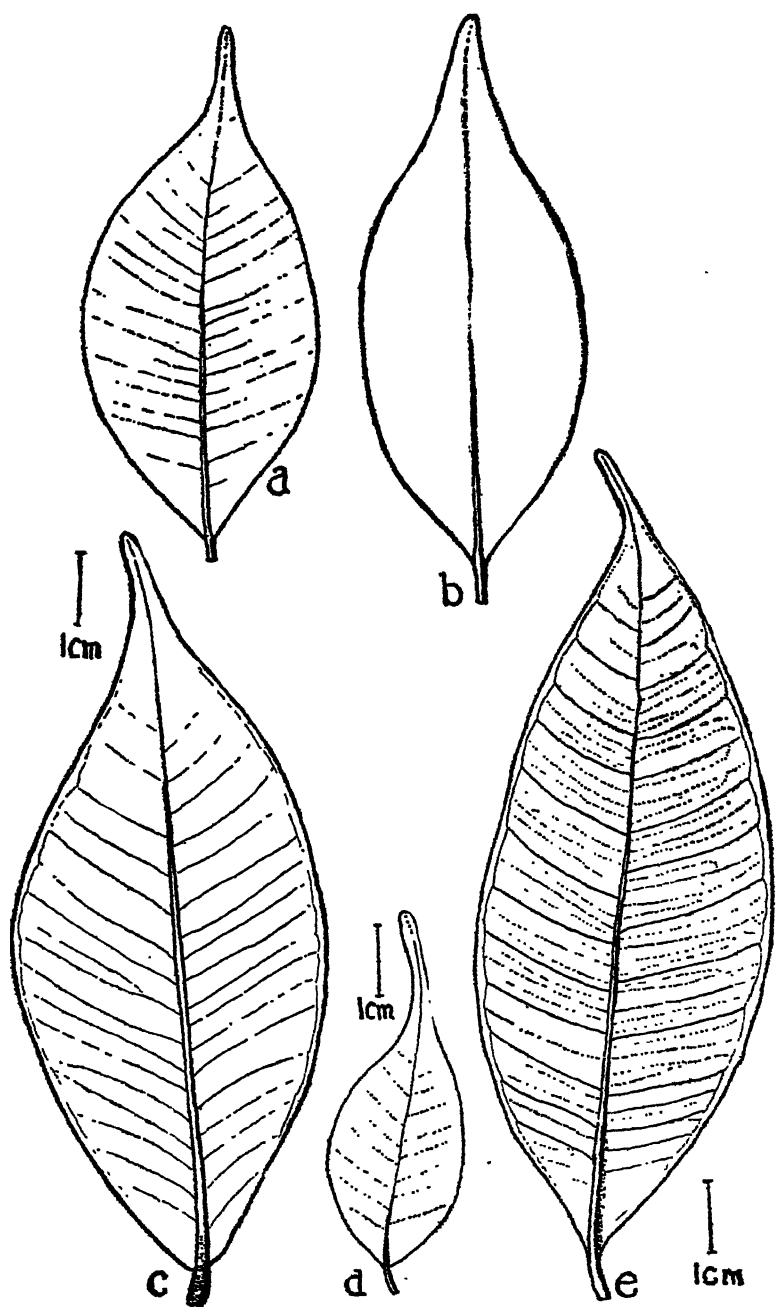


Fig. 45. a, b, *E. attenuata*; c, *E. attenuata* var. *montana*; d, *E. attenuata* var. *ophirensis*; e, *E. napiformis*.

SELANGOR: Kanching Forest Reserve, *Forest Dept. FMS 12474, 47141*; Sungai Lallang, *Forest Dept. FMS 24147*; Klang Gates, *SFN 10036 (Burkill), Forest Dept. FMS 13136, 33202, 33205, 37445, 39400*; Sungai Tinggi, *Forest Dept. FMS 44056*; Kuala Selangor, *SFN 34075 (Nur)*.

MALACCA: Merlimau, *Derry 1177*; sine loc., *Maingay K.D. 744*.

PAHANG: 28th mile, Cameron Highlands road, *Forest Dept. FMS 36292*.

JOHORE: Top of Gunong Banang, *Ridley 11054*.

SINGAPORE: Kranji road, *SFN 29056 (Corner)*; Bukit Timah, *SFN 34680 (Ngadiman), 34958 (Corner), 34777, 36381 (Henderson), 36115 (Kiah), 36440 (Liew)*.

*Distrib*: Borneo, Java.

A tree, trunk sometimes slightly fluted-buttressed at base; bark more or less coarsely papery flaky, but not strongly so except in young trees, scaling in rather large pieces, rufous orange or warm red brown; inner bark reddish brown or pinkish fawn. *Twigs* slender, the youngest acutely 4-angled or terete, bark drying whitish to pale brown, smooth or somewhat flaky in older twigs. *Leaves* coriaceous, lanceolate or elliptic lanceolate, apex usually long acuminate with obtuse acumen, or shortly, broadly and bluntly acuminate, base acute, from c. 3 cm.  $\times$  1.5 cm. to 8 cm.  $\times$  3 cm., both surfaces drying yellowish or brownish yellow, the lower paler, rather densely punctate above and usually finely black dotted below; midrib slightly impressed above, slightly raised below and more or less keeled; *primary nerves* numerous and close together (up to c. 30 pairs), usually almost or quite invisible above, very slightly raised and very fine below, joining a very fine intramarginal nerve 1 mm. or less from leaf margin, often almost invisible, especially in thick textured leaves; petiole up to c. 5 mm. long, transversely wrinkled when dry.

*Panicles* terminal or from upper few axils, up to c. 7 cm. long, usually shorter, pedunculate, the peduncle, rachis and branches slender, 4-angled, the bark drying pale and more or less pustulate; *flowers* white, in threes, fives, or rather dense clusters at the ends of the short, erect-spreading branches; *calyx* 6–8 mm. long, more or less pustulate, often conspicuously so, ribbed when dry and obscurely 4-angled, narrowed below the cyathiform upper part into a very slightly tapering tube c. 5 mm. long; lobes 5, shallow broad and rounded, or 4, ovate triangular, subsistent; *petals* free, orbicular, more or less gland dotted, c. 1.5 mm. diam., or calyptrate and more or less agglutinated; *stamens* numerous, filaments stout below, more or less glandular pustulate at base, up to c. 1.5 mm. long, anthers broadly ovate oblong, c. 0.2–0.3 mm. long, without connective gland,

anther sacs somewhat divaricate; *style* stout, tapering slightly to the truncate apex, coarsely glandular pustulate, c. 2 mm. long; *ovary* 2-celled, multiovulate.

*Fruit* oblong or oblong-obovoid, 7–8 mm. long, 4–6 mm. across, apex deeply and narrowly excavate, fringed with remains of calyx tube and stamens, pink or pale whitey green on one side; pericarp white, outer layer juicy pulpy or fleshy, rather thin, peeling away easily from the hard very fibrous endocarp; testa thin, adhering closely to cotyledons or occasionally coming away with pericarp; seed conforming to shape of fruit, with flattened apex, cotyledons dull pinkish brown with conspicuous darker gland dots, oblique, triangular with folded inner faces, the large hypocotyle lying in the fold and extending to the periphery of seed. Germination epigeal.

Apart from certain variations in the foliage of the specimens placed under this species, consisting mainly in the distinctness or obscurity of the venation, there are also variations in the flowers. The shape of the calyx tube remains rather constant, but there may be 5 rather inconspicuous shallow lobes or 4 more distinct subacute ones, the pustulations on the tube may be evident or obscure or absent, and the petals may be free and conspicuously glandular or almost entirely agglutinated into a thick calyptra without glands. It is unlikely, however, that more than one species is represented by the material cited.

Merrill and Perry hesitate to reduce *E. penangiana* to *E. attenuata* because of conflicting statements by King and Ridley, both of whom included *E. rhamphiphylla* and *E. napiformis* in their conception of the species, but typical *E. penangiana* agrees well with material quoted under *E. attenuata* by Merrill and Perry and it agrees with Koorders and Valetton's description and figure of that species as well as with the Buitenzorg material of it. *E. attenuata* is closely allied to *E. rugosa* but is distinguishable from it not only by its smaller and less conspicuously nerved leaves and by small differences in the flower, but also by its bark characters.

***E. attenuata* Koord. and Valet. var. *ophirensis* var. nov.**  
(Fig. 45d).

A typa foliis minoribus, latoribus, abrupte caudatis differt.

JOHORE: Mount Ophir, *Ridley s.n.*, 3298, TYPE collection, holotype in Herb. Singapore, 10059, *Feilding s.n.*

Apparently placed by Ridley under *E. caudata* King.

**E. attenuata** Koord. and Valet. var. **montana** var. nov.  
(Fig. 45c).

A typa foliis crassioribus, cortice ramulorum nigro, calycis lobis maioribus, tubo minus pustulato differt.

PAHANG: Cameron Highlands, 5,000 feet, SFN 23559 (Henderson), TYPE collection, holotype in Herb. Singapore, c. 4,000 feet, SFN 32595 (Nur); 47th mile, Telom road, SFN 31256 (Holtum).

128. **Eugenia rhamphiphylla** Craib in Kew Bull. (1930) 168; Fl. Siam. Enumer., I, 659. *Syzygium rhamphiphyllum* (Craib) C.E.C. Fischer in Kew Bull. (1937) 438. (Fig. 46a).

KEDAH: Bukit Tunggul, Forest Dept. FMS 12411.

PENANG: Government Hill, Curtis 2790; Penang Hill, 100 feet, SFN 35357 (Kiah).

Distrib: Burma, Siam.

A tree. Twigs slender, the youngest more or less angled, drying pale grey, older ones terete, drying brownish. Leaves thinly coriaceous, oblong oblanceolate or narrowly elliptic lanceolate, occasionally elliptic or oblong elliptic, apex obtusely or subacutely acuminate, base cuneate or long narrowed, from c. 5-8.5 cm. long and 2-4.5 cm. broad, both surfaces drying pale brown or reddish brown, the upper punctate or pustulate, the lower with minute scattered pustulations; midrib slightly impressed or flat above, more or less elevate below and keeled; primary nerves numerous, parallel and close together, curving up to an intramarginal nerve close to the recurved leaf margin, raised on both surfaces and very fine but distinct, especially below, sometimes obscure above, the reticulations almost as distinct; petiole slender, 5-6 mm. long, channelled above.

Panicles terminal or from upper axils, usually several together at tips of twigs, shorter than leaves, few flowered, usually with one pair of short branches, they and the peduncle slender, 4-angled; flowers sessile, in twos or threes or solitary at the ends of the branches or occasionally at the ends of very short branchlets; calyx c. 1.3 cm. long, longitudinally wrinkled and obscurely and minutely pustulate, campanulate above the ovary after anthesis, c. 4 mm. across mouth, suddenly contracted below to a slender pseudostalk c. 1 cm. long; lobes 5, obscurely glandular pustulate, the three outer persistent, ovate triangular, c. 1 mm. tall and a little more across base, the two inner ovate orbicular, c. 2 mm. diam.; petals 5, free, rather thick textured and obscurely glandular pustulate, orbicular, c. 2 mm. diam.; stamens numerous, filaments stout, tapering upwards, up to c. 4 mm. long, anthers ovate oblong, c. 0.4-0.5 mm. long, without connective gland; style stout,

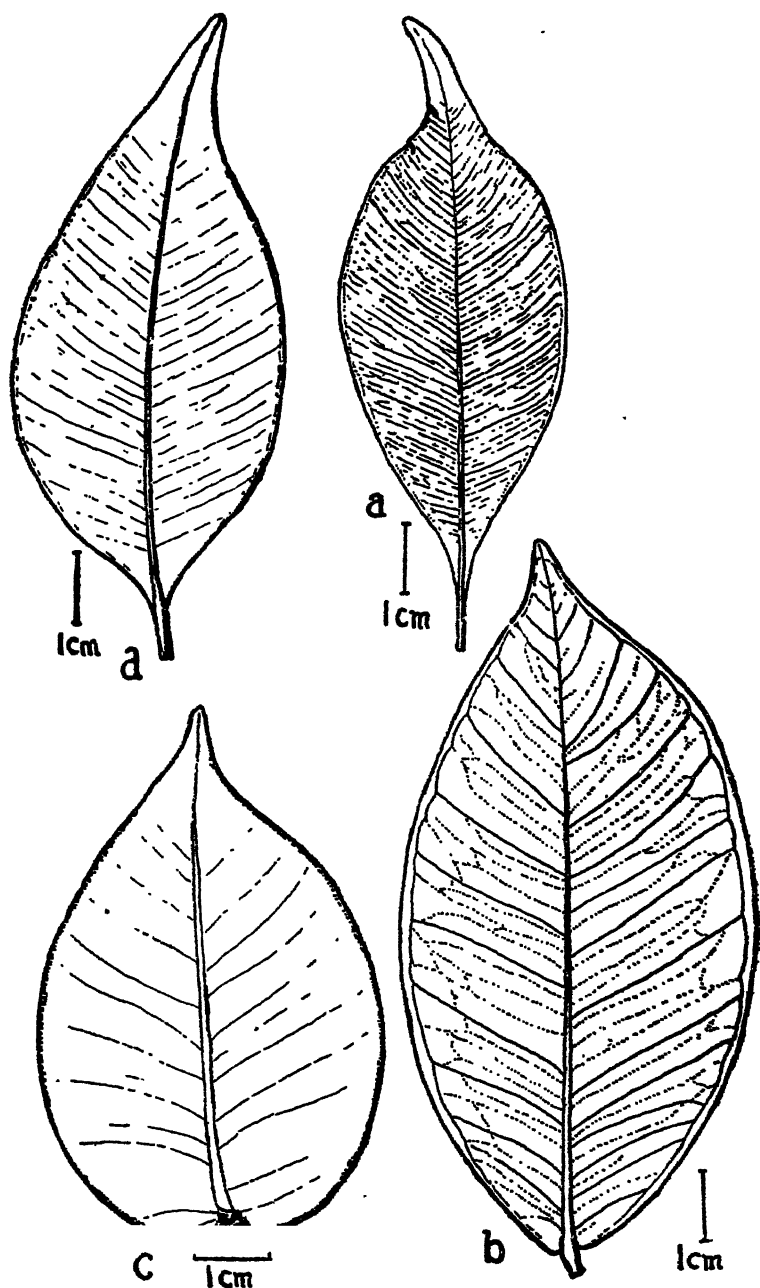


Fig. 46. a, *E. rhamphiphylla*; b, *E. rugosa*; c, *E. rugosa* var. *cordata*; d, *E. fusticulifera*.

narrowly conical with expanded truncate apex, 2-2.5 mm. long, hardly exceeding calyx rim; ovary 2-3-celled.

*Fruit* cylindric oblong or narrowly oblong obovoid, somewhat tapered to base, c. 2 cm. long and 6-8 mm. diam., pale when dry and finely wrinkled, with small but conspicuous dark gland dots, apex deeply excavate, c. 4-5 mm. across, with the very short calyx rim and remains of calyx lobes. (In the only fruiting material available, *SFN* 35357, the seed has not developed, although the fruit appears to be fully grown).

129. *Eugenia rugosa* (Korth.) Merr. in Journ. Roy. As. Soc. Str. Br., LXXVII, 224 (1917), quoad syn., non quoad pl. *Syzygium rugosum* Korth. in Nederl. Kruidk. Arch., I, 204 (1848); Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 185. *Syzygium rigidum* Wall., nom. nud., non *Eugenia rigida* DC. *Eugenia Goodenovii* King, Mat. F.M.P., No. 12, 117 (1901), pro parte; Ridl., F.M.P., I, 731, pro parte. *E. johorensis* Ridl., F.M.P., V (Suppl.) 308 (1925), non *E. johorensis* Ridl. (1912). *E. Motleyi* Ridl. in Journ. Bot., LXVIII, 33 (1930). (Fig. 46b).

PERAK: Lower Camp, Gunong Batu Puteh, *Wray* 1075; Larut, 1,000-1,500 feet, *Kunstler* 6965.

MALACCA: Merlimau, *Alvins* s.n.; sine loc., *Alvins* s.n.

PAHANG: Pramau, Pekan, *Ridley* s.n., 1021; Kuantan, *Forest Dept.* FMS 15071.

JOHORE: 4 miles N.W. of Johore Bahru, *SFN* 16352 (*Burkill & Haniff*), type collection of *E. johorensis* Ridl. (1925); Scudai river, *Ridley* s.n.; Yong Peng, *Corner* s.n.; Bukit Tinjau Laut, *Corner* s.n.

SINGAPORE: sine loc., *Cantley* s.n.; 15th mile Jurong road, *SFN* 26190 (*Corner*); Bukit Timah, *SFN* 34605 (*Corner*), *SFN* 34778, 34779, 35929, 35930, 35933 (*Henderson*), *SFN* 35798, 36190, 36200, 36403, 36404, 36409, 36412 (*Ngadiman*).

*Distrib*: Borneo.

A tree, trunk cylindric, slightly fluted at base, or with very short small buttresses; bark narrowly or irregularly fissured, outermost layers slightly papery flaky or not, flaking in small irregular pieces or in long strips, dull red or warm red or greyish-reddish-brown; inner bark thick, fibrous, bright pinkish red, turning mauve purple on exposure. *Twigs* slender, the youngest acutely 4-angled, drying pale and slightly pustulate, older ones obscurely 4-angled to terete, brown to greyish, smooth, becoming slightly flaky. *Leaves* decussate, thickly coriaceous, variable in shape and size even on the same tree, from narrowly oblong lanceolate to ovate elliptic or ovate, apex shortly acuminate or acute, often bent back, base broadly or

narrowly cuneate, from c. 6 cm. to 16 cm. long and 2 cm. to 7 cm. broad, upper surface usually shining, drying greenish brown to dark brown, more or less punctate or minutely pustulate, lower surface dull, often drying darker than the upper, minutely rugulose pustulate, or black dotted, or eglandular; midrib more or less impressed above, or channelled, elevate below, sometimes very slightly, usually more or less keeled; *primary nerves* c. 10–30 pairs, usually 0.5 cm. or less apart, often appearing close and numerous when secondaries are well marked, very slightly raised above and usually very obscure or invisible, raised and very fine below, sometimes obscure, meeting a faint intramarginal nerve 1 mm. or less from leaf margin; secondaries sometimes almost as distinct as primaries, sometimes obscure, reticulations obscure or invisible; petiole 3–10 mm. long.

*Inflorescences* terminal and axillary, short and densely flowered, reaching c. 4 cm. long, clustered, paniculate with few short branches or cymose, the peduncle and branches slender, angled and striate when dry; *flowers* sessile, usually in clusters at the ends of the branches and at apex of inflorescence, or in threes, twos or solitary, bracteoles very minute, broad, rounded, subpersistent; *calyx* pale green, minutely white dotted, somewhat angled and wrinkled when dry, smooth or slightly angled and ribbed in life, minutely glandular, narrowly obovoid in bud, 6 mm. to nearly 10 mm. long, after anthesis more or less funnel shaped, swollen above ovary and slightly constricted immediately below lobes, tapering gradually from below ovary to base, or slightly constricted below ovary; lobes 4 or 5, rather variable, broadly ovate, rounded or subacute; *petals* white, free, or calyptrate and partially agglutinated, rather thick textured, orbicular, up to c. 2 mm. diam.; *stamens* numerous, filaments white, up to c. 2.5 mm. long, stout, broad and flattened at base, tapering upwards, anthers ovate oblong, c. 0.4 mm. long, without connective gland; *style* stout, terete, 4–5 mm. long, hardly exceeding the calyx rim, apex truncate or rounded with conspicuous stigmatic surface; *ovary* 3-celled.

*Fruit* broadly obconic to slightly turbinate, up to c. 1 cm. long and 0.75 cm. across apex, bright red pink, apex more or less truncate with a deep narrow excavation c. 2 mm. diam., fringed with the short enlarged calyx lobes and withered stamens and bearing style remains; pericarp firm, outer layer white, juicy, pulpy when fully ripe, c. 1–2 mm. thick; endocarp hard, fibrous, dark green; seed more or less obovoid, c. 5 mm.  $\times$  3.5 mm., apex obliquely truncate, testa rather thick, pithy, loose, surface of cotyledons gland dotted and pustulate, pale pink, inner faces with longitudinal fold

and groove accommodating the large hypocotyle which reaches the periphery of the seed at its base. The structure is similar to that in *E. attenuata*.

This species varies in foliage and flowers in much the same way as does *E. attenuata*, but again there seems no basis for considering that more than one species is involved in the material cited.

***E. rugosa* Merr. var. *saxitana* (Ridl.) var. nov.**

*Eugenia saxitana* Ridl. in Kew Bull. (1928) 74.

SELANGOR: Ulu Semangkok, *Ridley s.n.*

PAHANG: Gunong Tahan, 5,000 feet, *Seimund 357* (type collection of *E. saxitana*).

The only differences between these collections and the plants placed under typical *E. rugosa* are the darker bark of the twigs of the variety, their somewhat thicker leaves, the nerves being obscure in *Seimund 357* but distinct below in Ridley's Ulu Semangkok specimen, and their mountainous habitat.

***E. rugosa* Merr. var. *cordata* var. nov. (Fig. 46c).**

A typa foliis subsessilibus, latioribus, basi cordatis differt.

KELANTAN: Gunong Stong, *Forest Dept. FMS 37692, 37720.*

PAHANG: Fraser Hill, *Forest Dept. FMS 27109*, TYPE collection, holotype in Herb. Kepong, 4,000 feet, *SFN 11211 (Nur)*.

SELANGOR: Sempang, *Ridley 15599.*

This looks at first sight very different from typical *E. rugosa*, but the only real difference is the broader cordate leaves. The collections cited above differ amongst themselves considerably in size of leaf, but typical *E. rugosa* does so also, even on the same tree, although never to the extent of having cordate leaf bases.

130. *Eugenia fusticulifera* Ridl. in Journ. Bot., LXVIII, 33 (1930). *Syzygium fusticuliferum* (Ridl.) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 184 (1939). (Fig. 46d).

PAHANG: Rompin, *Forest Dept. FMS 15602, 17157.*

Distrib: Borneo.

A tree. Twigs slender, terete, bark smooth, drying-pale brown or greyish. Leaves coriaceous, ovate lanceolate or ovate elliptic, apex bluntly acuminate, base acute, c. 6-8 cm. long and 2.75-3.5 cm. broad, both surfaces drying pale brown to cinnamon brown, the upper somewhat polished, minutely punctate, the lower dull, minutely pustulate; midrib slightly channelled above, more or less elevate below,

rounded or keeled; *primary nerves* numerous and close together, meeting an almost straight intramarginal nerve less than 1 mm. from leaf margin, slightly sunk above and almost invisible, raised below, very fine and rather indistinct; petiole drying black, c. 0.5 mm. long.

*Panicles* terminal or from upper axils, reaching c. 7.5 cm. long, either long pedunculate and lax with 1-3 distant pairs of branches, or rather dense and branched from base, peduncle and branches slender, 4-angled; *flowers* sessile, often in threes, or in clusters at the ends of the branches or of very short branchlets; *calyx* c. 1.3 cm. long, the upper part suddenly inflated, globose turbinate, c. 4-5 mm. diam., somewhat constricted immediately below lobes, the basal part forming a slender pseudostalk c. 7-8 mm. long; lobes 5, small, distant, ovate triangular subacute, gland dotted, c. 1 mm. across and 1 mm. tall; *petals* free, ovate oblong or ovate orbicular, pellucidly gland dotted, up to c. 2.5 mm. diam.; *stamens* numerous, filaments rather stout, subulate, minutely pitted, the outer ones reaching c. 2 mm. long, the inner ones with almost no filaments, anthers broadly elliptic, c. 0.2 mm. long, without connective gland; *style* stout, c. 4 mm. long, hardly reaching the calyx rim, stigmatic surface large and conspicuous; *ovary* 4-celled.

The elongate flowers with the apex of the calyx tube suddenly inflated and globose turbinate, the short stamens and the 4-celled ovary distinguish this species.

131. *Eugenia napiformis* Koorders and Valetton in Meded. Lands Plantent., XL, 120 (1900); Atlas Baumart. Java, III, fig. 489. *Syzygium napiforme* (K. & V.) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 183 (1939). (Fig. 45e).

PERAK: sine loc., *Scortechini s.n.*, 184; Larut, *Kunstler 3410*, 300-500 feet, *Kunstler 6759*; Sungai Larut, *Wray 3066*; Chanderiang, within 100 feet, *Kunstler 5651*.

NEGRI SEMBILAN: Gunong Angsi, *Forest Dept. FMS 23707*.

PAIANG: Raub, *Forest Dept. FMS 22570*; Cameron Highlands, *SFN 32950* (Nur).

*Distrib*: Borneo, Java.

A tree. *Twigs* slender, the youngest 4-angled, the older terete, bark drying pale brown to reddish or greyish brown. *Leaves* coriaceous or thinly coriaceous, elliptic lanceolate to elliptic or elliptic oblong, sometimes slightly obovate, apex acuminate, often shortly and abruptly so, base narrowed, from c. 4.5 cm. to 12 cm. long and 1.5 cm. to 6 cm. broad, both surfaces drying brownish or yellowish brown, the lower black dotted; midrib impressed above, more or less elevate below and somewhat keeled; *primary nerves* rather

numerous and close together, from c. 15 to over 30 pairs in large leaves, less than 0.5 cm. apart, very slightly raised above and usually obscure, slightly raised below and very fine, usually distinct, occasionally obscure, joining a fine intramarginal nerve close to the recurved leaf margin, secondaries and reticulations less distinct than primaries below, or obscure; petiole 3–6 mm. long, channelled above.

*Panicles* terminal, rather short and broad and densely flowered, shorter than leaves, peduncles and branches rather slender, more or less 4-angled with pale brown or yellowish brown wrinkled bark when dry; *flowers* sessile, in twos, threes or clusters at the ends of the branches or often in threes, twos or solitary at the ends of short branchlets; *calyx* up to c. 1.3 cm. long, the upper part narrowly cupular in bud, c. 3–3.5 mm. long and 3 mm. across mouth, after anthesis widely conic-cupular, c. 5 mm. across mouth, constricted below the cupular part into a slender pseudostalk c. 10 mm. long, the whole tube rather coarsely wrinkled-tuberculate and sometimes with reddish gland dots; lobes 4 or 5, persistent, broadly ovate rounded, less than 1 mm. tall; *petals* calyptrate, but the outer one free or partially free; *stamens* numerous, filaments slender, up to 7–8 mm. long, anthers broadly ovate oblong, c. 0.4 mm. long, without connective gland; *style* stout, subulate, c. 7–8 mm. long; *ovary* 3- or 4-celled.

*Fruit* obconic-turbinate or obovoid, up to c. 2 cm. long, whole of apex deeply excavate, c. 6–7 mm. diam., bearing the remains of the calyx lobes. (The local material available has no developed seeds. Koorders and Valetton figure the fruit as much more broadly turbinate than in any fruiting collection from the Malay Peninsula and describe the seed as having folded and excavate inner cotyledon faces, with a long terete hypocotyle).

The five preceding species (*E. attenuata*, *E. rhamphiphylla*, *E. rugosa*, *E. fusticulifera* and *E. napiformis*) appear to form a closely inter-related group, characterised by the peg shaped flowers, the upper part of the calyx tube more or less suddenly expanded, the lower part forming a long fine pseudostalk. The following table shows the main distinguishing points within the group:

*E. attenuata*—Leaves thick, not oblanceolate, with almost invisible or faint venation, especially above; flowers c. 6–8 mm. long, calyx tube wrinkled and often conspicuously pustulate; bark papery flaky.

*E. rhamphiphylla*—Leaves thin, often oblanceolate, with fine but distinct venation raised on both surfaces; the acumen longer than in

*attenuata*; flowers c. 1.3 cm. long, more abruptly expanded above ovary than in *attenuata* and the fruit larger.

*E. rugosa*—Leaves thick, usually larger than in *attenuata* or *rhamphiphylla*, primary nerves usually distinct below, not above; flowers c. 6–10 mm. long, calyx tube nearly smooth, gradually narrowed to base; bark not or only very slightly papery flaky.

*E. fusticulifera*—Flowers c. 1.3 cm. long, calyx tube globose turbinate above, very suddenly constricted below the inflated apex into a long slender pseudostalk:

*E. napiformis*—Venation fine, slightly raised below, obscure above; flowers very long, c. 1.3 cm., the upper part cupular after anthesis, calyx tube distinctly and roughly tuberculate.

132. *Eugenia virens* (Bl.) Koord. and Valet. in Meded. Lands Plantent., XL, 113 (1900). *Clavimyrthus virens* Blume, Mus. Bot. Lugd.-Bat., I, 114 (1849). *Eugenia fusiformis* Duthie in Hook. fil., F.B.I., II, 479 (1878); Ridl., F.M.P., I, 727. *Syzygium fusiforme* (Duthie) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 176 (1939). *Eugenia leptogyna* C. B. Rob. In Philipp. Journ. Sci., IV, 368 (1909). (Fig. 47a).

PERAK: sine loc., *Scortechini 2021*; Pondok Tanjong Forest Reserve, Forest Dept. FMS 9788.

MALACCA: sine loc., *Maingay K.D. 743*.

JOHORE: Mersing, Forest Dept. FMS 5927; Tempayan river, *Ridley 13252*.

SINGAPORE: Reservoir Jungle, *SFN 29225, 36291* (Corner), Corner s.n.; Raffles College grounds, *SFN 36293* (Nur).

Distrib: Borneo, Java, Philippines.

A tree reaching c. 21–22 m. tall, trunk fluted at base; bark very slightly scaly in small pieces, apparently smooth and entire at a distance, not pustulate, light pinkish fawn; inner bark rather thin, pallid fawn tan. Twigs rather stout, the youngest 4-angled with reddish brown bark, the older ones terete with greyish bark. Leaves coriaceous, lanceolate to elliptic or oblong elliptic, sometimes slightly obovate, apex shortly and bluntly acuminate or acute, base cuneate, variable in size, from c. 7.5 to 19 cm. long and 4 cm. to 8 cm. broad; both surfaces drying pale brown or yellowish brown to reddish brown, the upper darker, somewhat polished, closely and minutely punctate, lower surface dull, with minute, close, dark or concolorous pustulate glands; midrib rather shallowly and widely impressed

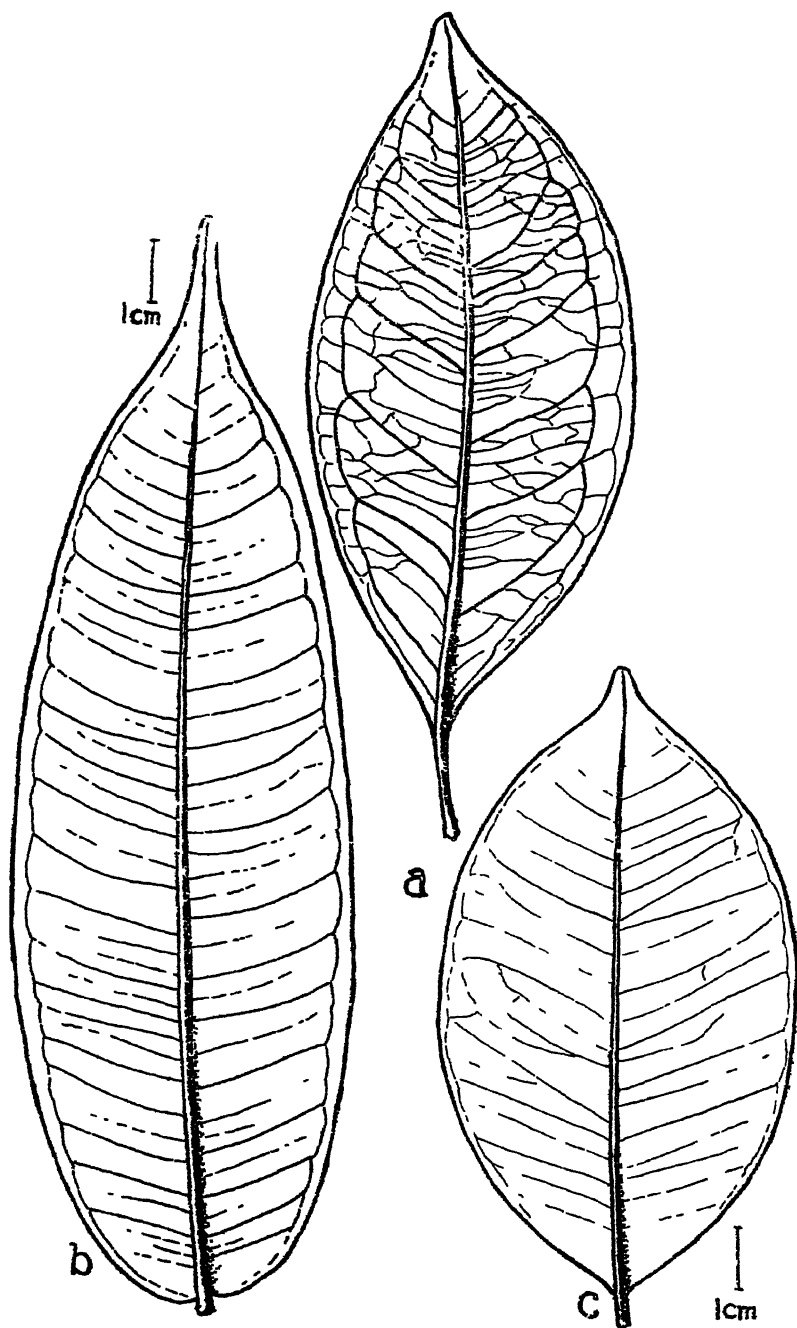


Fig. 47. a, *E. virens*; b, *E. claviflora* var. *Maingayi*; c, *E. claviflora* var. *leptalea*.

above, prominent below, more or less pustulate; *primary nerves* 10–14 pairs, elevate on both surfaces and very distinct, usually 1–2 cm. apart, obliquely ascending or curving up rather irregularly to a very distinct irregularly looped intramarginal nerve 0.5–1.2 cm. from the leaf margin, with one or two fainter series of loops closer to the margin; secondaries and reticulations also raised on both surfaces and distinct, but less prominent than primaries; leaf margin often obscurely crenulate; petiole 1–2 cm. long.

*Panicles* terminal or from the uppermost axils, often clustered, rather densely flowered, always shorter than the leaves, peduncles and branches 4-angled, becoming very stout in fruit; *flowers* usually in threes at the ends of the branches or of short branchlets, on pedicels 2–5 mm. long, fragrant, greenish white; *calyx* 1.2–1.4 cm. long, narrowly funnel-shaped-fusiform, slightly but distinctly swollen about ovary; lobes 4, green, unequal, very broad and rounded, persistent and reflexed after anthesis, the 2 larger 5–6–8 mm. across and 2.5–4 mm. tall, the two smaller 4–5–6 mm. across and 1.8–2.5 mm. tall; *petals* 4, free, white flushed pale pink in centre, orbicular or ovate orbicular: c. 6–8 mm. diam., concave and rather thick textured, reflexed after anthesis and dropping with the stamens; *stamens* numerous, white, filaments slender, terete, reaching c. 2 cm. long, anthers oblong, 0.8–0.9 mm. long, connective gland small and inconspicuous; *disc* thick, outer margin white, pale orange yellow within; *style* subulate, much stouter than filaments, c. 2 cm. long; *ovary* 2-celled, multiovulate.

*Fruit* ovoid, c. 2 cm. long and 1.75 cm. diam., smooth, apex with deep excavation c. 5 mm. diam., fringed with enlarged persistent calyx lobes; pericarp fleshy, 2–3 mm. thick; seed c. 1.2 cm. diam., rather irregularly globose or obovoid, testa dark brown, thick, crustaceous, adhering closely to cotyledons; cotyledons pale, glistening, minutely gland dotted, nearly equal, side by side or superposed, inner faces more strongly gland dotted, almost plane or a little folded, attached to hypocotyle near centre by short broad stalks, the hypocotyle variable in length but not reaching periphery of seed. Germination hypogeal, the shoot strongly red winged.

I have seen the type of *Clavimyrthus virens* Bl., and have no hesitation in reducing Duthie's species to it, although Blume's specimen is rather poor. King reduced *Clavimyrthus virens* to *E. filiformis* Duthie, but although some forms of the latter which have shorter pedicels than usual and in which the ventricose calyx tube is more pronounced, do have a superficial resemblance to *E. virens*, this species never has the characteristic long pedicels of *E. filiformis*.

133. *Eugenia pseudoclaviflora* Henderson in Gardens' Bulletin, Singapore, XI, 331, fig. 16 (1947).

PAHANG: Track to Gunong Tahan, c. 1,000 feet, on ridge, SFN 31755 (Kiah).

Known only from the above collection.

A tree 6-7 m. tall. Twigs slender, terete, bark drying dull blackish brown or reddish brown. Leaves lanceolate or oblong lanceolate, 4-8 cm.  $\times$  1.25-2.5 cm., drying greenish or yellowish, apex long acuminate or almost caudate acuminate, acumen acute, base long narrowed; midrib sunk above, elevate below and conspicuous, otherwise the nervation visible only in young leaves and then indistinct or invisible above and faint below; primary nerves when visible c. 10 pairs, spaced, meeting in a very obscure intramarginal nerve close to the somewhat thickened leaf margin; petiole blackish brown, wrinkled, up to c. 5 mm. long.

Cymes short, axillary, condensed, sessile or nearly so, shorter than leaves; flowers sessile; calyx narrowly clavate, the limb slightly cyathiform, the tube long narrowed, contracted at base into a short pseudostalk, slightly ribbed and finely rugulose-pustulate, c. 12.5 mm. long including pseudostalk, which is c. 2-2.5 mm. long; lobes 4, broadly rounded, shallow, c. 0.4-0.5 mm. high; petals usually calyptrate, or occasionally free, subsistent; stamens up to 4.5 mm. long, filaments slender, anthers broadly elliptic or ovate, c. 0.5 mm. long and 0.3-0.4 mm. wide, connective gland inconspicuous; style c. 8 mm. long, rather stout, more or less cylindric or very slightly fusiform below; ovary 3- or 2-celled. Fruit unknown.

The inflorescence of this species is very like that of *E. claviflora*, but the flowers are shorter and stouter. The foliage resembles that of *E. attenuata*.

134. *Eugenia claviflora* Roxb., Fl. Ind., II, 488 (1832); Duthie in Hook. fil., F.B.I., II, 484; King, Mat. F.M.P., No. 12, 107; Ridl., F.M.P., I, 742; Corner, Wayside Trees of Malaya, p. 495, figs. 168, 169; Wight, Ic., II, tabs. 528, 529, 530, 606 (1843). *Syzygium claviflorum* (Roxb.) Cowan & Cowan, Trees North-Beng., 67 (1929); Merr. & Perry in Journ. Arn. Arb., XIX, 221 (1938). *Syzygium clavatum* (Korth.) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 180 (1939). *Jambosa clavata* Korth., Nederl. Kruidk. Arch., I, 207 (1847). *Eugenia clavata* (Korth.) Merr. in Journ. Roy. As. Soc. Str. Br., LXXVII, 225 (1917). *E. rhododendrifolia* Miq. et forma *longifolia* Miq., Anal. Bot. Ind., I, 19, 20, t. 2, t. 3 (1850). *Jambosa borneensis* Miq., Fl. Ind. Bat., I, i, 434 (1855).

*Syzygium viridifolium* (Elmer) Merr. & Perry in Mem. Amer. Acad. Arts & Sci., XVIII, 3, 183 (1939). *Eugenia viridifolia* Elmer, Leaf. Philipp. Bot., IV, 1420 (1912). *E. Fraseri* Ridl. in Journ. Bot., LXVIII, 33 (1930). *E. ruminata* Koord. & Valet. in Meded. Lands Plantent., XL, 117 (1900); Atlas Baumart. Java, III, fig. 486. (Fig. 49a).

LANGKAWI: sine loc., Forest Dept. FMS 20780; Gunong Raya, Forest Dept. FMS 6779; Telok Datai, SFN 7515 (Haniff & Nur).

PERLIS: Besih Hangat, Ridley 15064.

TRENGGANU: Kuala Trengganu, SFN 15159 (Holtum), Corner s.n.

PENANG: Muka Head, 500 feet, Curtis 749; seacoast, Curtis 697; Waterfall, Curtis s.n.; Batu Ferenghi road, Ridley 8393; Moniot's road, Ridley 7089; Waterfall Gardens, SFN 36257 (Ewart), Ewart s.n. (tree No. 605); sine loc., Stoliczka s.n.

PERAK: Pulau Rumpia, Seimund s.n.; Lumut, Ridley 7954; Pangkor, Forest Dept. FMS 1750, Ridley 8384.

PAHANG: Pulau Duchong, SFN 29857 (Corner); Putat Forest Reserve, Forest Dept. FMS 10792; Pahang East, Forest Dept. FMS 6751.

SINGAPORE: Government House Domain, Ridley 11245, Addison s.n.; Labrador, Corner s.n.; Pasir Panjang, Corner s.n.

Distrib: Sikkim, Bengal, Assam, Burma, Indo-China, China, Siam, Anamba Islands, Borneo, Java, Philippines.

A medium sized to tall *tree*, trunk cylindric, often branched near base, with very small short buttresses; bark smooth or finely longitudinally creviced, occasionally peeling in small patches or becoming slightly fissured and somewhat flaky, with peculiar shallow oblique indentations like healed scars c. 2.5-5 cm. long, pale whitey grey; inner bark very hard and dry, dull vinaceous drab. *Twigs* slender, terete or somewhat compressed, with grey or brown, smooth or slightly flaky bark. *Leaves* thinly coriaceous, lanceolate or oblong lanceolate or narrowly elliptic or elliptic oblong, variable in size, from c. 7-22 cm. long and 3-8.5 cm. broad, apex shortly and often bluntly acuminate, or acute, base cuneate, both surfaces drying pale brown to pale reddish brown, the upper somewhat the darker, very minutely punctate, the lower sometimes with minute dark or concolorous pustulations; midrib impressed above, prominent below; *primary* nerves from c. 12 to 25 pairs, irregular in spacing, from c. 3 mm. to 10 mm. apart, slightly raised and usually rather faint above, raised and fine below, distinct or very distinct, obliquely ascending or curving up, often branched, to a fine intramarginal nerve 1-2 mm. from leaf margin; *secondaries* and *reticulations* only a little less distinct than the *primaries*, the *secondaries* often difficult to distinguish from them; *petiole* usually less than 5 mm. long.

*Flowers* in very short condensed corymbs 2.5-5 cm. across, from the twigs below leaves, or axillary, sessile; *calyx* in bud narrowly cylindric clavate, 1.5-2.5 cm. long, trumpet shaped after anthesis, or the upper part of tube funnel shaped or cupular, c. 4-5 mm. across mouth, slightly constricted or gradually narrowed to base, with usually a short, slender, and not well defined pseudostalk, creamy white or greenish white tinged pink above; lobes 4 (? or 5), broadly ovate rounded or ovate triangular subacute, 1 mm. or less tall, persistent; *petals* white, falling in a calyptra but not or only partially agglutinated, ovate orbicular, thin, with a few obscure pellucid gland dots; *stamens* numerous, filaments slender, terete, reaching c. 9-10 mm. long, anthers oblong or elliptic oblong, 0.7-0.9 mm. long, without connective gland; margin of disc reddish pink; *style* stouter than filaments, subulate, glandular pustulate, c. 9 mm. long; *ovary* 3-celled (? or 2-celled).

*Fruit* when ripe broadly spindle shaped to ovoid or globose or oblong globose, up to c. 2 cm. long and nearly as broad, ripening from greenish pink through pink and dark red to purplish black; apex deeply excavate and fringed by the remains of the enlarged calyx lobes and bearing style remains; outer layer of pericarp juicy pulpy, nearly white, 2-3 mm. thick; a fibrous endocarp present which is distinct from the soft outer layer; the endocarp can be removed leaving the very thin brown testa on the seed, but in specimens preserved in alcohol the pulpy layer has shrunk and become firm and the whole of the pericarp peels off and brings with it the testa; seed 1, more or less obovoid, with truncate depressed apex with a deep narrow excavation, the margin of the truncate apex with raised vertical ridges extending some way down over the outer surface of the cotyledons; cotyledon surfaces very pale green, smooth and finely gland pitted, or pustulate, the cotyledons side by side with a vertical groove on one side following the commissure and filled with the thickened testa, the commissure on the other side just visible as a fine wavy line; cotyledons firmly locked together but not fused, so that it is possible to prise them apart, but usually with difficulty and with some fracturing of the tissues; inner faces pale, irregularly rugose with rounded depressions and projections fitting into one another. An irregularly branching dark brown structure occupies more than half the volume of the cotyledons and ramifies through their tissue. Whether or not this brown tissue is continuous with the testa and intrudes from the external groove has not been made out. No trace of radicle or plumule can be seen. On germination the radicle protrudes from the

base of the seed, its tissue apparently continuous with that of the basal part of the seed. The cotyledons never separate, but remain as a solid mass until long after the seedling is well established.

As far as I can discover, Koorders and Valet., in their description of *E. ruminata*, are the only authors to draw attention to the very curious structure of the seed of this species. They describe it as "Semina testa tenuis cum placenta intra cotyledones conferruminatas intus valde ruminatas intrusa".

Roxburgh mentions that the fruit of *E. claviflora* is eaten in Chittagong. In Penang the ripe fruit is preserved as a pickle and known as *Buah Rumayu*.

A much wider view is taken here of the species than by most other authors. As defined here it is a polymorphic and widely distributed group. To it should perhaps also be added *E. teretiflora* Koord. & Valet., which I have not seen. However, when fruit of all the various forms is obtained, a reclassification of them may be necessary.

Wight, Ic., tab. 530 almost certainly represents *E. claviflora*. It is certainly not *E. lanceolata* Lamk., a photograph of the type of which I have seen. Tab. 529, labelled *E. Wightiana* Wight, also represents *E. claviflora*. I have seen no very authentic material of *E. Wightiana*, but if the series of specimens so named in Herb. Dehra Dun is to be relied upon, it differs.

Only rather poor material of *E. ruminata* Koord. & Valet. has been available, but this, along with the authors' description and figure, makes the reduction reasonable. The description and drawing of the fruit and seed of *E. ruminata* correspond very closely to the peculiar structure found in *E. claviflora*.

***E. claviflora* Roxb. var. *leptalea* (Craib) var. nov. (Fig. 47c).**

*E. leptalea* Craib, Fl. Siam. Enum., I, 649 (1931). *E. leptantha* Wight, Ill., II, 15 (1841); Duthie in Hook. fil., F.B.I., II, 484; Ridl., F.M.P., I, 741; non Benth. (1840). *E. claviflora* Roxb. var. *leptantha* King, Mat. F.M.P., No. 12, 108 (1901). *Syzygium leptanthum* (Wight) Niedenzu in Engl. & Prantl., Nat. Pflanzenfam., III (7), 85 (1893); Merr. & Perry in Journ. Arn. Arb. XIX, 222.

PERLIS: Bukit Lagi, Ridley 15065.

PAHANG: Pratau, Pekan, Ridley 1019, 1109.

Distrib: Range of typical form.

Differs from the typical form in having the leaves broader in proportion to their length, and in the smaller flowers, c. 1 cm. long.

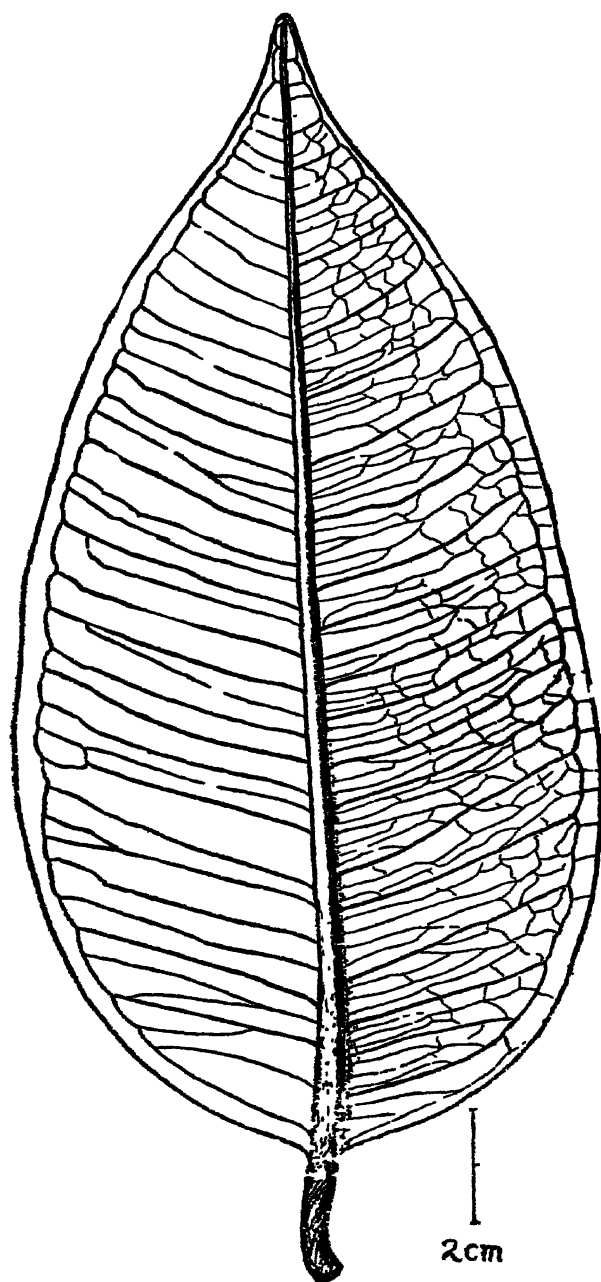


Fig. 48. *E. claviflora* var. *montana*.

**E. claviflora** Roxb. var. **excavata** King, Mat. F.M.P., No. 12, 108 (1901). (Fig. 49c).

PENANG: Sungai Telok Bahang, *SFN 4560* (*Burkill*); Richmond Pool, Penang Hill, *Ridley s.n.*

PROVINCE WELLESLEY: Permatang Bertam, *Ridley 6970*.

PERAK: Ulu Kendrong, Upper Perak, *Forest Dept. FMS 11603*; Bubu Forest Reserve, *Forest Dept. FMS 29803*, 30889; Larut, 500-1,000 feet, *Kunstler 7440*.

PAHANG: Sungai Teku, 500 feet, *SFN 31925* (*Kiah*); Rotan Tunggal Forest Reserve, *Forest Dept. FMS 28536*.

? SINGAPORE: "Victory Island", *Hullett s.n.*

*Distrib*: ? Endemic.

Differs from the typical form in the rough bark of the twigs, the leaves usually longer and broader, the venation below more pronounced and the intramarginal nerve much more distinct.

**E. claviflora** Roxb. var. **Maingayi** King, Mat. F.M.P., No. 12, 108 (1901). *E. Maingayi* Duthie in Hook. fil., F.B.I., II, 484 (1878). *E. claviflora* Roxb. var. *glandulosa* King, loc. cit. (Fig. 47b).

KELANTAN: Chabang Tongkat, *Forest Dept. FMS 37847*; Sungai Jerai, *Forest Dept. FMS 37824*.

PENANG: Government Hill, *Maingay K.D. 750* (type collection of *E. Maingayi* Duthie).

MALACCA: Mount Ophir, *Hullett 780*.

JOHORE: Ulu Kahang, c. 250 feet, *SFN 10879* (*Holttum*); 13½ mile Mawai-Jemaluang road, *SFN 31940* (*Corner*).

*Distrib*: ? Endemic.

Distinguished by the acutely angled and winged young twigs, or twigs with corky fissured bark, thicker leaves and rather faint nerves. The Kelantan collections have rather smaller thinner leaves than the others, rounded and minutely cordate at base, not shortly and abruptly narrowed.

I have rearranged the varieties given by King in the Materials. for I believe that he included more than one form, including the typical one, under his var. *excavata*, and that var. *glandulosa* is not sufficiently distinct.

**E. claviflora** Roxb. var. **riparia** var. nov. (Fig. 49b, Fig. 50).

A *typa foliis lineari-lanceolatis*, ad. 15 cm. longis et 1.5 cm. latis differt.

PAHANG: Kuala Tahan, *Seimund 927*, TYPE collection, holotype in Herb. Singapore; Tahan river, *Corner s.n.*

A well marked narrow-leaved river bank form.

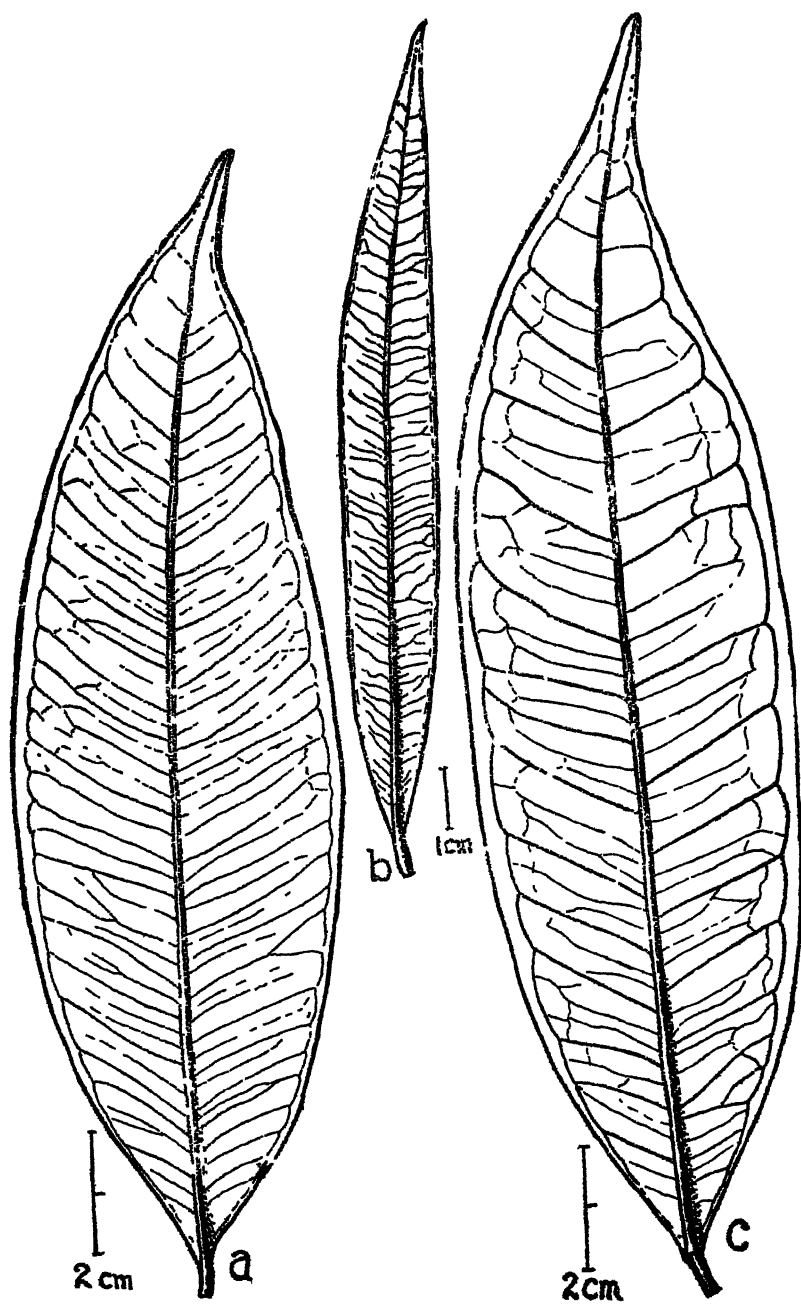


Fig. 49. a, *E. claviflora*; b, *E. claviflora* var. *riparia*; c, *E. claviflora* var. *excavata*.

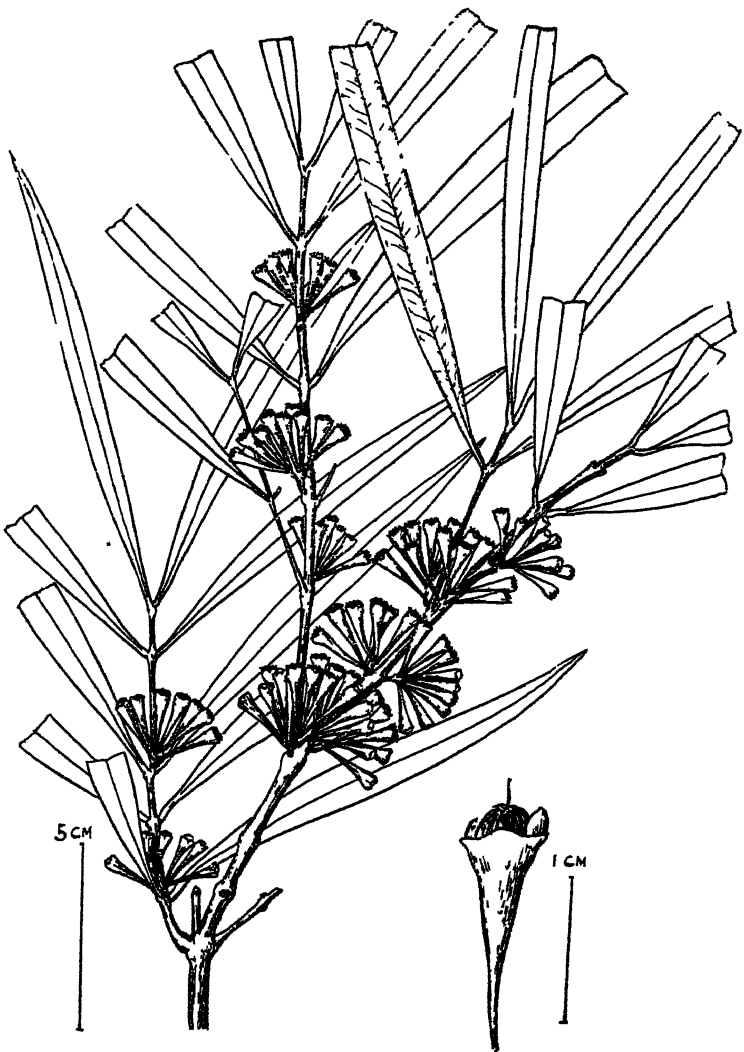


Fig. 50. *E. claviflora* var. *riparia*.

Del: CHAN YORK CHYE.

**E. claviflora** Roxb. var. **montana** var. nov. (Fig. 48).

A typa folia crassioribus, ramulis crassis angulatis, floribus interdum longioribus differt.

KEDAH: Kedah Peak, *FMS Mus.* 6019 (Robinson & Kloss).

TRENGGANU: Gunong Padang, 4,000 feet, *SFN 33914* (Moysey & Kiah), TYPE collection, holotype in Herb. Singapore.

PAHANG: Wray's Camp, Gunong Tahan, *Ridley 16273*.

JOHORE: Gunong Janeng, *Lake & Kelsall 4076*; Gunong Belumut, summit, *Holtum 98*.

The collections placed under this variety differ considerably amongst themselves. *Ridley 16273* has ovate or ovate lanceolate leaves with a cuneate base and distinct petiole, and flowers larger than the typical form. *Lake & Kelsall 4076* has oblong lanceolate leaves, rounded at the base and practically sessile, with flowers of the typical form. *FMS Mus.* 6019 has oblong lanceolate leaves, narrowed at the base and shortly petiolate, with flowers of the typical form. *SFN 33914* has large ovate leaves with a broad base abruptly narrowed to a distinct stout petiole, and flowers larger than the typical form. *Holtum 98* has leaves rather like *SFN 33914*, but more narrowed to a rounded somewhat oblique base.

Of the five varieties enumerated here fruit of two only has been available—of var. *Maingayi*, of which *SFN 31940* is a fruiting collection in which the seed structure corresponds closely to that of the typical form; and of var. *montana*, of which *Holtum 98* is a fruiting collection in which, unfortunately, the seeds have been destroyed by insect larvae.

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§ **ACMENA**—Anther cells globose, divaricate, opening by terminal slits; seed pseudomonocotyledonous.

135. *Eugenia Cumingiana* Vidal, Phan. Cuming. Philipp., 173 (1885); Craib, Fl. Siam. Enum., I, 636; Corner, Wayside Trees of Malaya, p. 496. *Myrtus acuminatissima* Bl., Bijdr., 1088 (1826). *Acmena acuminatissima* (Bl.) Merr. & Perry in Journ. Arn. Arb., XIX, 12 (1938). *Eugenia acuminatissima* Kurz, Pegu Report, App. A, 63 (1875); Duthie in Hook. fil., F.B.I., II, 483; King, Mat. F.M.P., No. 12, 126; Koord. & Valet. in Meded. Lands Plantent., XL, 155 (1900); Atlas Baumart. Java, III, fig. 506, excl. fruit; Ridl., F.M.P., I, 747; non Miq. (1847) nec Berg. (1857–59).

*E. saligna* C.B. Rob. in Philipp. Journ. Sci., Bot., IV, 392 (1909), non *Jambosa saligna* Miq. (Fig. 51a, Fig. 52).

Widespread in Malaya and fairly frequent, usually in lowland forest and secondary growth, but recorded from Cameron Highlands at about 4,500 feet.

*Distrib*: Assam. Tenasserim, Andaman Islands, Siam, South China, Sumatra. Bangka, Natuna Islands, Java, Borneo, Philippine Islands, Solomon Islands.

A medium sized to large tree, base of trunk sometimes stilt rooted; bark nearly smooth or slightly flaky or slightly fissured or rugose, not papery, pale brownish or pinkish fawn; inner bark thin, pale pinkish or pinkish fawn; wood yellowish. Youngest *twigs* slender, 4-angled, older ones terete, drying pale brown or reddish brown with smooth bark becoming slightly flaky. *Leaves* usually thinly coriaceous, lanceolate or oblong lanceolate, sometimes ovate lanceolate, apex caudate acuminate or long acuminate, the acumen usually long, narrow, and acute, base cuneate or narrowly acute, variable in size, usually c. 9 cm.  $\times$  3-4 cm., but varying from c. 5-13 cm. long and 1.5-5 cm. broad, upper surface smooth, drying greyish green or pale brown or pale reddish brown, minutely punctate, lower surface drying pale brown or reddish brown, sparsely black dotted; midrib impressed above, elevate below; *primary nerves* c. 8-15 pairs, slightly raised on both surfaces, usually faint above, faint or rather distinct, but fine below, from c. 3 mm. to 10 mm. apart, ascending rather irregularly and curving up to a fine intramarginal nerve 1-4 mm. from leaf margin, secondaries and reticulations usually faint or obscure, occasionally almost or quite as distinct as primaries; petiole drying dark and transversely wrinkled, up to c. 1 cm. long.

*Panicles* terminal or occasionally from upper axils, usually lax with many distant branches, reaching c. 12 cm. long, peduncle and divaricate branches slender, 4-angled, with longitudinally wrinkled pale bark when dry; *flowers* small, white, sessile, usually in threes, sometimes in twos or solitary, at the ends of the slender ultimate branchlets; *calyx* turbinate-clavate, c. 3-4 mm. long, the lower half suddenly contracted into a slender pseudostalk, the upper part after anthesis more or less cupular and c. 2 mm. across mouth; lobes 5, subsistent, minute, broadly triangular acute; *petals* 4 or 5, free, erect, orbicular or oblong ovate c. 1 mm. tall; *stamens* numerous, the longest slightly less than 1 mm., filaments broad at base, anthers very small, c. 0.1 mm. across, the cells globose, divaricate, opening by terminal slits; *style* very stout, reaching or slightly exceeding the calyx rim; *ovary* 2-celled.

*Fruit* depressed globose, up to c. 2 cm. across, almost black when ripe, apical umbilicus c. 3–4 mm. diam., sunken, sometimes with remains of calyx lobes; pericarp fleshy, white; seed 1, when just beginning to germinate more or less depressed globose, semi-reniform, the brown semi-crustaceous testa still adhering closely to cotyledons. No commissure is visible and it is impossible to separate the cotyledons. When cut open the seed appears to be a solid mass of tissue with a dark brown mass ramifying through it, entering the cotyledons near the apex of the seed. There is no movement apart of the cotyledons on germination, and the seed is still a solid mass of tissue when the seedling is 10 cm. tall. The first scale leaves may be alternate, opposite, or the first pair opposite and the next alternate. One seedling had three alternate leaves, then an opposite pair.

The structure of the seed is similar to that of *E. claviflora*, carried further towards complete fusion of the cotyledons.

There is a considerable range of variation in the foliage characters of the specimens cited. *Curtis 654* from Penang Hill and *Forest Dept. FMS 32* from the Larut Hills have smaller more closely nerved leaves than the typical form and superficially look very like *E. rhamphiphylla* Craib, but the acute acumen of the leaf in *E. Cumingiana* would serve to distinguish these species if no flowers or fruit were available. The set of specimens from Cameron Highlands has much thicker, more coarsely nerved leaves with shorter and denser inflorescences. Merrill and Perry also draw attention to the variability in this widely distributed species, and in connection with their remarks on the leaves being not always truly opposite, it may be pointed out that this occurs in other species of *Eugenia* in the section *Syzygium*, especially on young twigs. In *E. filiformis* for example, it is possible occasionally to find a twig with all the leaves alternate.

C. B. Robinson reduces *Jambosa saligna* Miq. to this species, apparently without having seen Miquel's specimen and relying on the synonymy given in Koorders and Valetton, Meded. Lands Plantent., XL, 155. I have seen Miquel's type and agree with Craib and Merrill and Perry that it does not belong here.

A full discussion and synopsis is given by Merrill and Perry, loc. cit., of *Armena* as a generic segregate from *Eugenia*, and a description of the curious seed structure which is characteristic of this section of the genus.

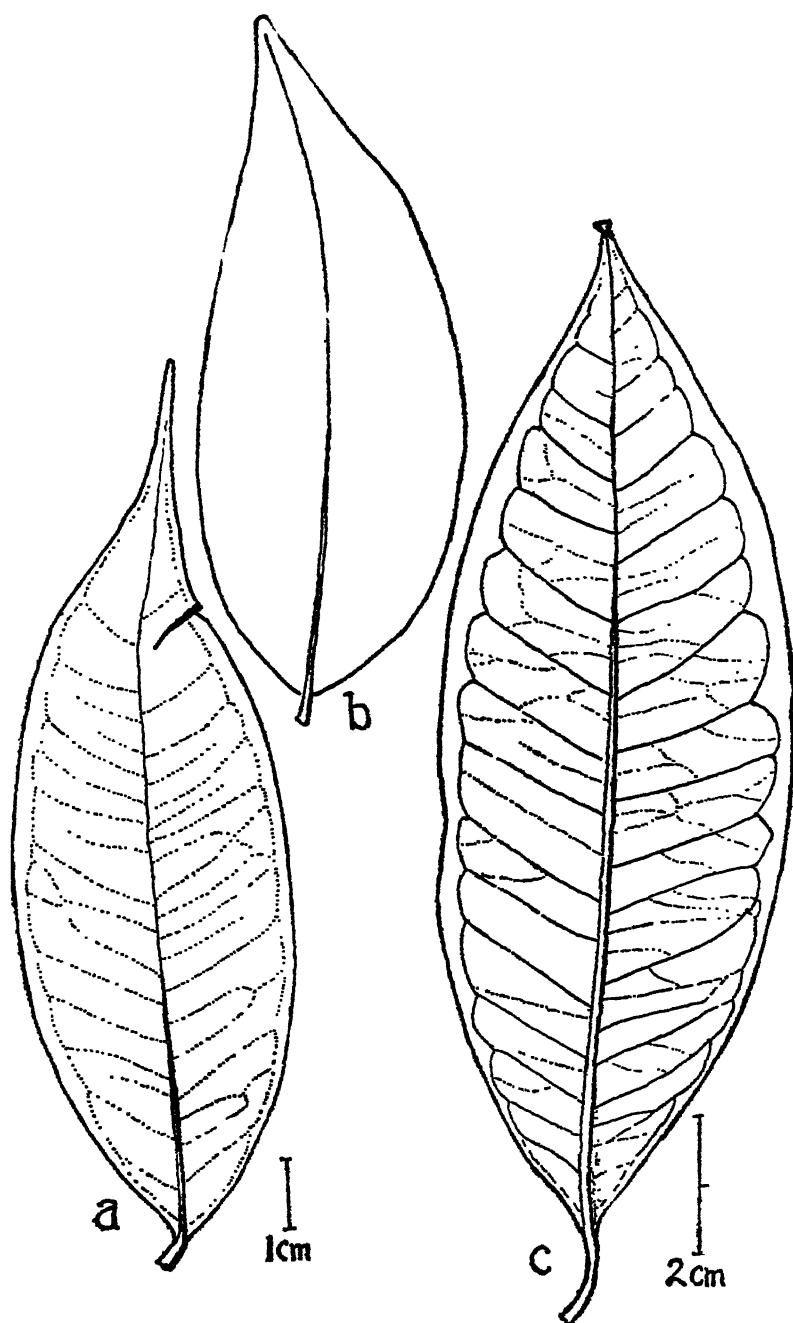


Fig. 51. a, *E. Cumingiana*; b, c, *E. operculata*.

§ CLEISTOCALYX—Calyx calyptrate, the upper part falling as a lid.

136. *Eugenia operculata* Roxb., Fl. Ind. II, 486 (1832); Hort. Beng. 37 (1814), nomen nudum; Wight, Ic. Pl. II, t. 552 (1842); Duthie in Hook. fil., F.B.I., II, 498; King, Mat. F.M.P., No. 12, 129; Koord. & Valet. in Meded. Lands Plantent., XL, 148 (1900); Atlas Baumart. Java, III, fig. 503; Ridl., F.M.P., I, 754. *Syzygium operculatum* (Roxb.) Niedenzu in Engl. & Prantl, Nat. Pflanzenfam., III, vii, 85 (1893). *Cleistocalyx operculata* (Roxb.) Merr. & Perry in Journ. Arn. Arb., XVIII, 337, pl. 215 (1937). (Fig. 51b, c, Fig. 53).

KEDAH: Kampong Naka, 100 feet, SFN 19801 (Holttum); Inchong Estate, 20 feet, SFN 36349 (Spane).

PENANG: Penara Bukit, 1,000 feet, Curtis 1444.

PERAK: sine loc., Scortechini 306; Matang, seacoast, Wray 2725; Dindings, Ridley 8388.

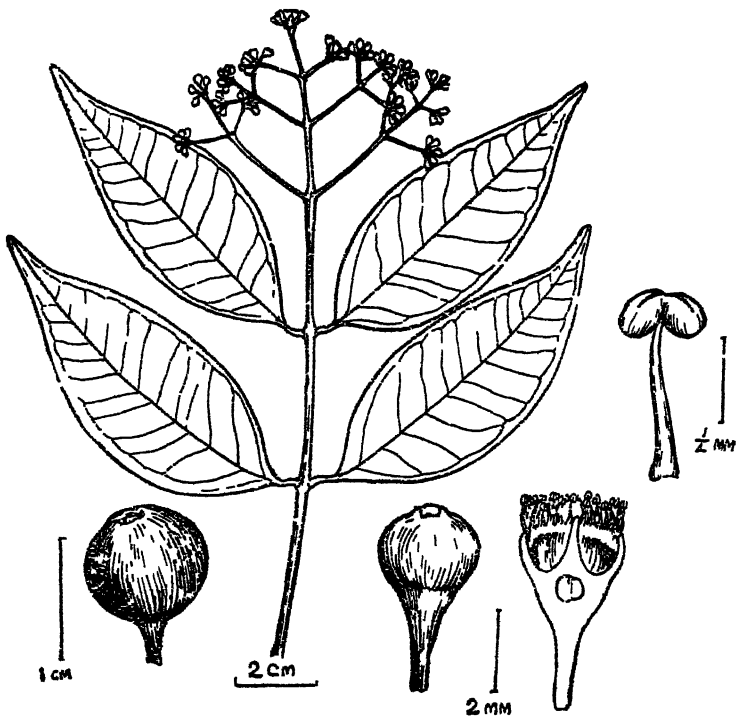


Fig. 52. *E. cumingiana*.

Del: CHAN YOEK CHYE.

SELANGOR: Kuala Selangor, Forest Dept. FMS 43746; Klang river, Forest Dept. FMS 14010; Sungai Pelek, Sepang, Denny 58, s.n.

PAHANG: Tembeling, SFN 21803 (Henderson).

Distrib: India, Burma, China, Indo-China, Siam, Sumatra, Java, Borneo, Philippines, ? Amboina, Australia.

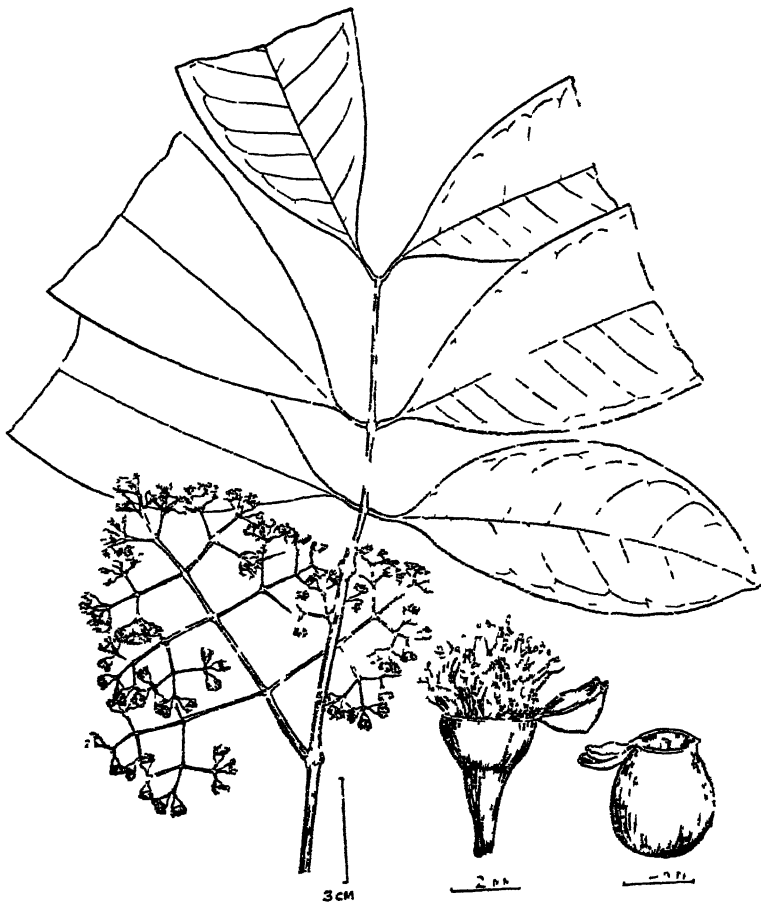


Fig. 53. *E. operculata*.

Del: CHAN YORK CHYE.

A tree; bark almost smooth, finely creviced into small pieces, pale greyish brown, inner bark thick, pallid buff. Twigs slender, youngest compressed and grooved, somewhat pustulate, drying brown, older ones terete, drying greyish. Leaves thinly coriaceous, variable in shape, oblong lanceolate or elliptic lanceolate to ovate oblong, apex shortly and

bluntly acute or acuminate, base cuneate, from c. 9 cm.  $\times$  3 cm. to 22 cm.  $\times$  7 cm.; upper surface drying greenish brown to reddish brown, more or less shining, closely and minutely gland dotted, lower surface dull, usually pale brown, gland dotted or pustulate; midrib impressed above, elevate below, pustulate; *primary nerves* c. 8–15 pairs, distant (usually c. 1 cm. apart), slightly raised or channelled above, pale, distinct, elevate and distinct below, nearly straight or curving up to a rather fine intramarginal nerve 3–6 mm. from the leaf margin, with sometimes a further series of fainter loops nearer the margin; secondaries and lax reticulations very faint above, much less conspicuous below than the primaries; petiole up to c. 1.5 cm. long, channelled above.

*Panicles* from twigs below leaves, rarely terminal, reaching c. 8–10 cm. long (longer in fruit), pedunculate, trichotomous, lax, with long, distant, almost horizontal branches, they and the peduncle slender, more or less 4-angled; *flowers* green or yellow in bud, turning red, in threes at branchlet ends, sessile, or the centre flower of the triads occasionally shortly pedicellate; *calyx* in bud completely closed, obovate-globose apiculate, 4.5–5.5 mm. long, gland dotted, the upper part falling as a circumscissile, orbicular, conic, apiculate, gland dotted calyptra 3–3.5 mm. diam., after anthesis the calyx somewhat campanulate, the margin recurved, rather abruptly narrowed into a stout, tapering 4-angled pseudostalk c. 2 mm. long, the mouth truncate or irregularly wavy with the remains of the calyptra; *petals* apparently 4, adhering to the inside of the calyx calyptra and falling with it, but separable, oblong ovate or ovate orbicular, thin, conspicuously gland dotted, margins lacerate, 2–2.5 mm. diam.; *stamens* numerous, filaments slender, terete, sparsely glandular pustulate, up to c. 6 mm. long, anthers oblong elliptic, c. 0.4 mm. long, connective gland conspicuous; *style* much stouter than filaments, subulate, sparsely glandular, c. 10 mm. long; ovary 2- or 3-celled.

*Fruit* ovoid globose, c. 1 cm. long, ripening from white to bright red and finally dark red, with dark gland dots when dry, apex with a wide, deep excavation c. 4 mm. diam., fringed by the short calyx rim; seed 1, oblong globose, c. 7 mm. long, testa pithy-leathery, adhering closely to cotyledons; cotyledons side by side, nearly equal, subreniform, inner faces conspicuously gland dotted, excavate, interlocking by thin broad bands of tissue arising from the margins of the cotyledons on one side and curving inwards, and attached to the stout quadrangular conspicuously gland dotted hypocotyle which reaches the surface of the seed.

Merrill and Perry, loc. cit., pp. 322-343, give an account of *Cleistocalyx* as a generic segregate from *Eugenia* and enumerate the species.

§ FISSICALYX—Henderson in Gardens' Bulletin, Singapore, XI, 333 (1947).

Calyx tube produced above disc, the stamens arising from its inner surface above the disc, the tube splitting longitudinally after the flower opens into several irregular lobes.

Calyx in bud c. 2.5 cm.  $\times$  1 cm.,  
primary nerves c. 15 pairs,  
intramarginal nerve 0.5-0.7  
cm. from margin .. 137 *Symingtoniana*.

Calyx c. 4 cm.  $\times$  3 cm., primary  
nerves 18-25 pairs, intramar-  
ginal nerve 2-3 mm. from  
margin .. .. 138 *Watsoniana*.

These two species appear to be aberrant in *Eugenia* in the characters given above. So far as I can discover, the position of the stamens, scattered over the inner surface of the calyx tube above the disc, has not been described previously in Myrtaceae, and these plants might be better placed in a new genus. However, only rather scanty dried material has been available, and the flowers have become so hard and woody that a detailed and exact examination of them has been difficult. Apart from the flowers, no-one familiar with *Eugenia* would hesitate to place these plants in that genus.

137. *Eugenia Symingtoniana* Henderson in Gardens Bulletin, Singapore, XI, 333, fig. 17 (1947). (Fig. 54a).

PERAK: Sungai Sah, Kinta, Forest Dept. FMS 14721, 38055.  
PAHANG: Bukit Goh Forest Reserve, Kuantan, Forest Dept.  
FMS 3136; Baloh, Kuantan, Forest Dept. FMS 3719;  
Gunong Rokam, Pulau Tioman, 2,500 feet, SFN 18779  
(Nur).

TRENGGANU: Sungai Paka, Forest Dept. FMS 26723; Ulu  
Brang, c. 800 feet, SFN 33750 (Moysey & Kiah), specimen  
with immature fruits, identification doubtful.

A tree c. 3-13 m. tall. Twigs terete, smooth, drying whitish or greyish white. Leaves elliptic to elliptic oblong, occasionally oblong lanceolate, up to 20 cm.  $\times$  10 cm., apex abruptly short acuminate or sometimes abruptly caudate, base cuneate and more or less decurrent on petiole; primary nerves up to c. 15 pairs, 0.75-2 cm. distant, impressed above, prominent but not thick below, running nearly straight or

curving gently up to an intramarginal nerve 0.5–0.7 cm. from margin, a much fainter intramarginal c. 0.2 cm. from margin; secondaries and reticulations faint above, distinct below, reticulations rather lax; upper surface drying fuscous dull or greyish brown, lower a warmer reddish brown; petiole stout, up to c. 1 cm. long.

*Flowers* usually solitary or occasionally in pairs at ends of branches, sessile; *calyx* in bud subglobose to obovoid, c. 2.5 cm. long and 1 cm. wide when mature, more or less campanulate after anthesis, slightly swollen about ovary, constricted at base into a short stout pseudostalk; lobes ? 4, short, round, gland dotted; the tube splitting deeply after anthesis into several deep irregular triangular false lobes; *petals* ? 4, free, thin, suborbicular with a short broad claw, c. 5–6 mm. diam., apparently often subsistent as are the calyx lobes, and adherent to the apices of the rolled back false calyx lobes; *disc* lining calyx tube to c. 0.5 cm. above ovary; *stamens* borne on the whole surface of the calyx tube above disc, the tube being produced c. 1 cm. above disc; filaments very numerous, slender, c. 1.5 cm. long; bases of the fallen stamens giving the inner surface of the rolled back false calyx lobes a tessellate appearance; anthers oblong, 0.6–0.7 mm. long, without conspicuous connective gland; *ovary* 2-celled, multiovulate.

*Fruit* apparently reaching c. 3 cm. diam., apex crowned with the remains of the calyx tube and recurved calyx lobes, c. 1.5 cm. diam.

138. *Eugenia Watsoniana* Henderson in *Gardens Bulletin*, Singapore, XI, 336, fig. 18 (1947). (Fig. 54b).

SELANGOR: Sungai Lallang Forest Reserve, *Forest Dept. FMS 22928*; Kanching Forest Reserve, *Forest Dept. FMS 9563, 5795*; Rantau Panjang Forest Reserve, *Forest Dept. FMS 595*.

A tree up to c. 10 m. tall. *Twigs* terete, with smooth or slightly flaky bark, almost white or greyish white. *Leaves* more or less coriaceous, narrowly elliptic to oblong elliptic, base narrowed, apex very abruptly and shortly acuminate or shortly acute, up to 20 cm.  $\times$  8 cm.; petiole rather stout, c. 1–1.5 cm. long, the lamina occasionally somewhat decurrent upon it; *primary nerves* 18–25 pairs, 0.75–1.5 cm. apart, more or less impressed above, prominent below but not thick, nearly straight or curving gently up to a well marked intramarginal nerve usually 2–3 mm. from leaf margin; secondaries and reticulations usually almost invisible above, not conspicuous below.

*Flowers* apparently solitary and terminal, sessile, large; *calyx* more or less campanulate, shortly narrowed at

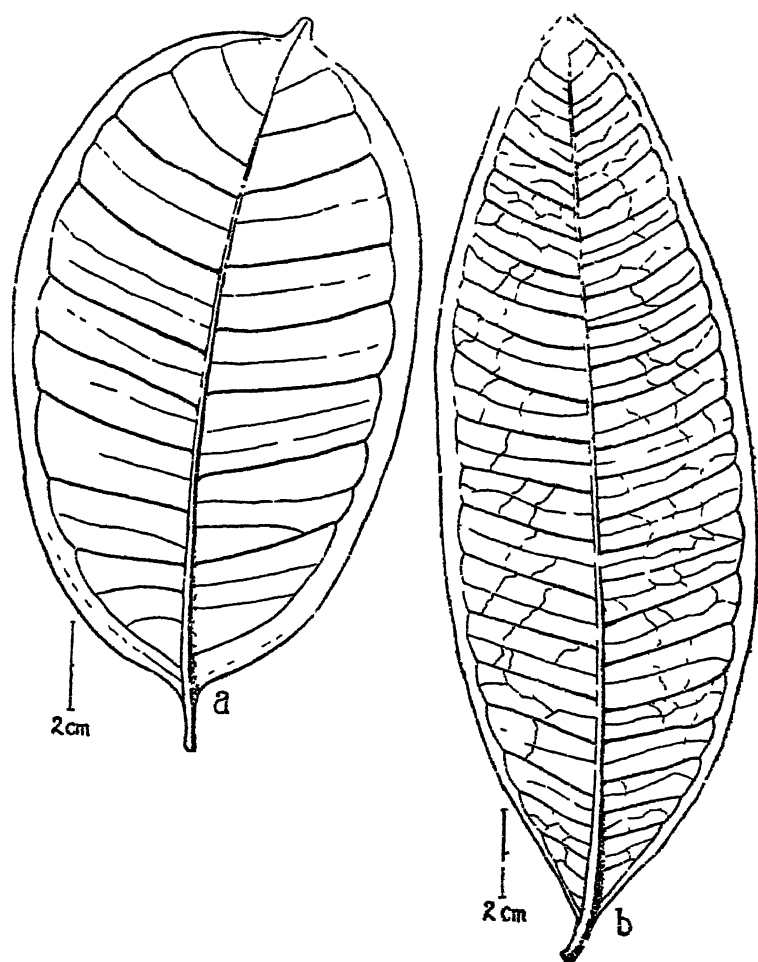


Fig. 54. a, *E. Symingtoniana*; b, *E. Watsoniana*.

base to a very short stout pseudostalk, smooth or faintly longitudinally ribbed and thick and leathery in texture when dry, in mature bud c. 4 cm. long and 3 cm. across, lobes 4, short, broad and rounded, the calyx tube after anthesis splitting into 6 or 7 rather irregular lobes 1-1.5 cm. long; *petals* not seen; *stamens* very numerous, borne on the surface of the calyx tube above disc, filaments very slender, c. 1.5-2 cm. long, anthers oblong, c. 0.7 mm. long, connective gland inconspicuous; *style* stouter than filaments, c. 3 cm. long; *ovary* 2-celled below, 4-celled above, multiovulate.

*Fruit* globose or depressed globose, 5–6 cm. diam., smooth or very faintly vertically ribbed when dry, crowned by the massive remains of the calyx tube 6–9 mm. tall and c. 2 cm. diam., fringed by the recurved false calyx lobes; pericarp hard and woody when dry, 5–7 mm. thick, testa nearly 1 mm. thick; cotyledons nearly equal, probably sessile, their inner faces apparently almost plane or slightly concave, attached to the hypocotyle near their centres.

Closely allied to *E. Symingtoniana* but distinguished from it by the more numerous primary nerves of the leaf, the larger flowers and in the stamens arising from a smaller area of the calyx tube.

### EXCLUDED AND ADDITIONAL SPECIES

*Eugenia tetrahaedra* (Miq.) Duthie in Hook. fil., F.B.I., II, 476 (1878).

Duthie identifies with *Jambosa tetrahaedra* Miq. a specimen collected by Griffith, and *Maingay K.D. 732*, both from Malacca. *Maingay K.D. 732* in Herb. Kew is *E. grandis* Wight. *Griffith K.D. 2370* in Herb. Calcutta is *E. palembanica* (Miq.) Merr. This sheet bears the following pencilled note: "Leaves exactly as in *Jambosa*? *tetrahaedra* Miq., but branches are here terete," and is probably the specimen referred to by Duthie (loc. cit. p. 477) when he says "Kurz in an MS note in the Calcutta Herbarium suspects that this is the *E. tetrahaedra* of Miquel but with some hesitation on account of the terete branchlets". I have examined a duplicate of the type of *Jambosa tetrahaedra* Miq. No Malayan material is referable to it. A cover in Herb. Calcutta bears the following pencilled note in King's hand: "Duthie's *E. tetrahaedra* F.B.I., II, 476 is *E. lepidocarpa* Wall."

*Eugenia ciliaris* Ridl., Kew Bull. (1928) 74.

This is *Decaspermum montanum* Ridl. in Journ. Roy. As. Soc. Str. Br., LXI, 6 (1912): F.M.P., I, 718.

*Eugenia aromatica* Kuntze, Rev. Gen., 239 (1891).  
*Caryophyllus aromatica* Linn., Sp. Pl. 735 (1753);  
*Eugenia caryophyllata* Thunb., Diss. I (1799); Koord.  
 & Valet., Atlas Baumart. Java, III, fig. 478.

Usually a small tree of conical shape, reaching c. 20 m. tall; twigs ascending, terete, smooth, greyish white. Leaves coriaceous, lanceolate or narrowly elliptic, sometimes narrowly obovate, up to 12 cm. × 4.5 cm., apex very shortly and broadly bluntly acuminate, base long narrowed, upper

surface glossy dark green, lower dull and paler; *primary nerves* over 20 pairs, irregularly spaced but usually less than 5 mm. apart, fine and translucent in the living leaf, intramarginal nerve fine, close to the somewhat wavy and recurved leaf margin; secondaries almost as distinct as primaries; petiole slender, up to c. 2.5 cm. long, the leaf blade decurrent upon it, the basal 5-6 mm. somewhat swollen and pinkish.

*Panicles* terminal, corymbose, trichotomous, shortly pedunculate or branched from base, shorter than leaves, few-many-flowered; *flowers* fragrant, usually in threes at branchlet ends, on stout variable pedicels, the centre flower of the triads usually on a much shorter pedicel than the outers; bracts and bracteoles narrow, acute, 2-3 mm. long, quickly caducous; *calyx* tube c. 1-1.5 cm. long, c. 5 mm. diam. below lobes, green in bud, cylindric, angled, base very slightly narrowed, without pseudostalk, flushed pink at anthesis and turning deep reddish pink after the stamens fall, lobes 4, narrowly ovate acute, fleshy, c. 3-4 mm. tall, erect and slightly incurved and green in bud, erect-spreading and pink after anthesis; *petals* 4, green, falling in a hemispherical calyptra c. 6 mm. diam. but not agglutinated and easily separable, orbicular, c. 6 mm. diam.; *stamens* very numerous, appearing grouped in 4 masses, arising from between the outer edge of the rather prominent narrow disc and the calyx tube, filaments nearly white, glandular pustulate, inner ones c. 3 mm. long, the longest outer ones reaching 9-10 mm., anthers yellow, ovate or ovate oblong, c. 0.5 mm. long, connective gland small, pale brown and inconspicuous; *style* very stout, swollen at base, very pale green and gland dotted, c. 4-4.5 mm. long; *ovary* 2-celled, multiovulate.

*Fruit* oblong, usually shortly tapered to each end, 2.5-3 cm. long, 1.3-1.5 cm. diam., apex with the 4 enlarged narrow fleshy calyx lobes incurved over and hiding the apical excavation; pericarp thin, pulpy fleshy, c. 2-3 mm. thick; seed 1, pinkish purple tinged green, with purplish testa, oblong, rounded at both ends, c. 2 cm. long; cotyledons side by side, inner faces gland dotted, excavate and folded and interlocking, attached near their centres to the large hypocotyle, which reaches the periphery of the seed at apex or base or midway; germination epigeal.

The clove tree, native of the Moluccas and nowadays cultivated in Malaya only to a limited extent, mostly in Penang.

## NOTES ON THE SEED STRUCTURE OF SOME EXOTIC SPECIES OF EUGENIA.

*E. apiculata* DC. (Chilean). Seeds 1-3, in the 1-seeded fruits flattened, more or less reniform, c. 4.5-5 mm. long, testa thick, brown, adhering to but peeling easily from cotyledons; cotyledon surfaces dull green, gland dotted, the commissure along the narrow edge, cotyledons quite free, interlocking, attached to the large terete truncate hypocotyle close to periphery of seed.

*E. bracteata* Roxb. (E. Indian). Seed globose, c. 8 mm. diam., testa dark brown, thick, brittle-crustaceous; cotyledons smooth, pale yellowish brown, the commissure equatorial but not complete, the inner faces fused for about one-half or one-quarter of their area; cotyledons, including the free parts of the inner faces, covered with an exceedingly fine epidermis-like layer.

*E. carissoides* Muell. (Australian). Seed more or less globular, flattened, c. 1 cm. diam.; cotyledons partially fused together, sometimes round the periphery and free within, or fused for one-third or one-quarter of the area of the opposing faces.

*E. cordata* Laws. (S. African). Fruit oblong obovate, c. 2 cm. long, dark reddish purple when ripe; pericarp spongy-juicy, white. Testa usually persistent; cotyledons free, the inner faces slightly excavate, attached to the short hypocotyle by very short broad stalks. Often polyembryonic.

*E. costaricensis* Berg. (Costa Rican). Seed flattened, horseshoe shaped, two blunt incurved points at one end; testa brown, adhering closely to cotyledons; cotyledons gland dotted, apparently completely fused.

*E. cyanocarpa* Muell. (Australian). Fruit somewhat oblong globose, c. 1 cm. long, apical umbilicus c. 5 mm. diam., rather deep with rather conspicuous calyx rim and more or less persistent calyx lobes, style base persistent; pericarp apparently pulpy; seed more or less globose, c. 7-8 mm. diam., testa thick, brown, leathery, not adhering strongly to cotyledons but not peeling with the pericarp; cotyledons free, somewhat unequal, side by side, conspicuously gland dotted, inner faces somewhat concave, not folded or interlocked, sessile, attached to hypocotyle near periphery.

*E. Dombeyana* DC. (Peruvian). Seeds flattened, more or less reniform, c. 1 cm. or more across, testa smooth, rather tough and leathery, not adhering closely to cotyledons; cotyledons smooth or slightly wrinkled, free only at one side and there interlocking, otherwise fused together.

*E. Luehmanni* Muell. (Australian). Fruit more or less spindle shaped, c. 1.4 cm. long and 6–8 mm. diam.; seed irregularly globose, c. 5 mm. diam., with brownish leathery testa adhering closely to the more or less wrinkled and conspicuously gland dotted cotyledon surfaces; cotyledons more or less equal, attached by very broad, thin, triangular stalks to a long stout hypocotyle grooved on one side and reaching the periphery of the seed.

*E. Michellii* Lam. (S. American). Seed oblong or subreniform, cotyledons entirely or partially fused together. Germination hypogeal.

*E. supra-axillaris* Spring. (Brazilian). Seed more or less globose, 5–6 mm. diam., testa rather thick and hard, adhering closely to cotyledons; cotyledons apparently completely fused together, no commissure visible, remaining as a solid mass of tissue until after the seedling is established.

## LIST OF COLLECTORS' NUMBERS.

- ALVINS—45: spicata; 68: filiformis; 79: Muelleri; 82: spicata; 146: pachyphylla; 236: spicata; 258: tumida; 273: papillosa; 422: conglomerata; 436: Scortechinii; 543: filiformis; 668: Duthieana; 784: filiformis var. clavimyrthus; 808: inophylla; 881: pachyphylla; 932: spicata; 1021: grandis; 1202: tumida; 1282: pachyphylla; 1295: tumida; 1503b: Muelleri; 1648: Cumini; 1735: Muelleri; 1760: spicata; 1860: grandis; 1862: valdevenosa; 1954: javanica; 1964: Scortechinii; 2045: inophylla; 2280: subdecussata; 3302: Scortechinii; 3329: Scortechinii var. cuneata.
- ANDERSON—76: Muelleri.
- BARNES—10869: spicata var. tenuiramis; 10882: subdecussata.
- CANTLEY—12: pseudosubtilis; 34: chlorantha; 37: pseudosubtilis; 45: palembanica; 49: papillosa; 50: Cumingiana; 58: Duthieana; 75: filiformis; 76: polyantha; 186: pseudoformosa; 212: pustulata; 212: polyantha; 214, 219: chlorantha; 2636: filiformis; 2678, 2680: longiflora; 2689, 2692: pergamentacea; 2785: tumida; 2937: syzygioides; 2942: spicata; 2961: Muelleri; 3031: papillosa; 3041: Duthieana; 3112: Cumingiana; 3151: pseudosubtilis; 3165: Cumingiana; 3205: grata.
- CANTLEY'S COLLECTOR—3128: tumida.
- CLEMENS—30248: valdevenosa; 31300: pterophorum.
- CUMING—2405: spicata.
- CURTIS—32: pseudosubtilis; 55: valdevenosa; 114: spicata; 179: Kunstleri; 180: chlorantha; 193: attenuata; 194: Griffithii; 212: Helferi; 247: cerasiformis; 317: grata; 511: polita; 653: Duthieana; 654: Cumingiana; 666: laevicaulis; 697: claviflora; 728: longiflora; 744: caudata; 749: claviflora; 750: laevicaulis; 751: grandis; 756: grata; 794: Haniffii; 864: subdecussata; 937: inophylla; 937: nigricans; 973: oblata; 974: inophylla; 975: Bernardi; 976: nigricans; 1089: fastigiata; 1090: filiformis var. clavimyrthus; 1114: javanica; 1152: glauca; 1428: pseudosubtilis; 1440: pergamentacea; 1442: densiflora; 1443: filiformis var. clavimyrthus; 1444: operculata; 1445: polyantha; 1448: Griffithii; 1448: chlorantha; 1466: spicata; 1510: valdevenosa; 1534: Griffithii; 1539: chlorantha; 2007: caudata; 2228: glauca; 2244: fastigiata; 2245: grata; 2246, 2247: laevicaulis; 2410: Thumra var. penangiana; 2417: longiflora; 2621: oblata; 2750: longiflora; 2778: glauca; 2790: rhamphiphylla; 2845: Bernardi; 2898: syzygioides; 2971: polyantha; 2972: attenuata; 3010: Ridleyi; 3175: fastigiata; 3275: Griffithii; 3287:

- Helferi; 3431: densiflora; 3435: syzygioides; 3440: glauca var. pseudoglauca; 3456: longiflora; 3475: pseudosubtilis; 3498: Duthieana; 3593: chlorantha; 3601: Thumra var. penangiana; 3601: Ridleyi; 3625: subdecussata; 3700: pachyphylla; 3731: syzygioides; 3758: caudata; 3807: chlorantha; 3827: Helferi.
- CURTIS'S COLLECTOR—12707: cerasiformis; 12721: Cumin-giana; 12723: longiflora.
- DENNY—56: conglomerata; 58: operculata; 60: pachyphylla; 61: conglomerata; 62: longiflora; 113, 114: microcalyx.
- DERRY—21: Muellieri; 53: tumida; 106: spicata; 133, 138: pendens; 147: pachyphylla; 221: longiflora; 256: Duthieana; 269: palembanica; 289: anisosepala; 451, 471: filiformis; 476: subdecussata; 516: longiflora; 531: pachyphylla; 550, 968: longiflora; 974: palembanica; 975: subdecussata; 1039: longiflora; 1097: grandis; 1104: glauca; 1107: pseudosubtilis; 1154: cerina; 1175: Griffithii; 1177: attenuata; 1178: cerasiformis; 1194, 1230: filiformis; 1238: glauca.
- DIEPENHORST—3083: avene.
- ELMER—21223, 21237: pustulata; 21448, 21460: fastigiata; 21518, 21762: Kunstleri.
- FEDERATED MALAY STATES MUSEUMS (FMS MUS.)—6019: claviflora var. montana; 6080: subdecussata var. montana; 7656: longiflora; 8023, 8307: Scortechinii; 9273: grata; 9365, 9485: pseudoformosa; 9488, 10488: subdecussata; 10604, 10687: pendens; 10769: pseudosubtilis; 11595: cerasiformis; 11696: Stapfiana; 12139: pahangensis; 12180: viridescens; 12244, 12249: pahangensis; 13181: spicata; 13183, 13185: oblata; 13186: grata.
- FOREST DEPARTMENT, FEDERATED MALAY STATES (FOREST DEPT. FMS)—20: tumida; 27: longiflora; 32: Cumin-giana; 159: longiflora; 205: pseudosubtilis; 212: leptostemon; 257: Griffithii; 262: papillosa; 266: densiflora; 328: spicata; 343: Stapfiana; 363: filiformis; 368: variolosa; 381: filiformis; 457: variolosa; 472: microcalyx; 516: fastigiata; 550: palembanica; 572: microcalyx; 573: anisosepala; 573: horizontalis; 579: pergamentacea; 579: filiformis var. clavimyrthus; 580: subdecussata; 580: anisosepala; 595: Watsoniana; 596: leucoxylon; 623: polyantha; 641: Ridleyi; 682: longiflora; 802, 804: Cumingiana; 855: polyantha; 894: filiformis var. clavimyrthus; 905: longiflora; 913: fastigiata; 936: variolosa; 962: longiflora; 1010: subdecussata; 1128: filiformis var. clavimyrthus; 1139: subdecussata; 1217: tumida; 1223:

Bernardi; 1250: microcalyx; 1268: Dyeriana; 1416: grandis; 1576: perakensis; 1578: cerina; 1589: chlorantha; 1603: glauca var. pseudoglauca; 1652: grata; 1682: grandis; 1750: claviflora; 1809: tumida; 1830: polyantha; 1850: grata; 1879: longiflora; 1960: Ridleyi; 2053: Griffithii; 2058: longiflora; 2082a: pustulata; 2082b: Ridleyi; 2105: Griffithii; 2155: polyantha; 2279: variolosa; 2283: tetraptera; 2287: valdevenosa; 2314, 2325: syzygioides; 2351: longiflora; 2358: grandis; 2407: longiflora; 2441: polyantha; 2633: chlorantha; 2671: polyantha; 2701: Cumingiana; 2704, 2772: grandis; 2787: densiflora var. angustifolia; 2793: cerasiformis; 2927: grandis; 2934: Scortechinii; 2939: filiformis var. clavimyrtus; 3022: tumida; 3023: longiflora; 3130: filiformis; 3136: Symingtoniana; 3202: palembanica; 3202: Hemsleyana; 3302: papillosa; 3308: variolosa; 3345: syzygioides; 3615: cerina var. turbinata; 3618: grandis; 3624: densiflora var. angustifolia; 3702: cerasiformis; 3719: Symingtoniana; 3726: grandis; 3908: polyantha; 3912: Curtisii var. minor; 3914: pseudosubtilis; 4003, 4007: polyantha; 4028: Scortechinii var. cuneata; 4106: cerina var. turbinata; 4157: nitidula; 4185: grandis; 4208: cerina var. turbinata; 4210: oblongifolia; 4211: densiflora; 4494: Griffithii; 4582: longiflora; 4749: microcalyx; 4783: pallidula; 4892, 4902: microcalyx; 4962: grandis; 5113: microcalyx; 5191: fastigiata; 5302: leptostemon; 5385: filiformis; 5460: pseudosubtilis; 5667: Cumingiana; 5707: inophylla; 5750: perakensis; 5795: Watsoniana; 5927: virens; 6016: longiflora; 6057: polita; 6365: filiformis; 6392, 6407: microcalyx; 6435: grandis; 6439: Griffithii; 6439: valdevenosa; 6656: anisosepala; 6682: polita; 6691: grandis; 6751: claviflora; 6766: nigricans; 6779: claviflora; 7015: Griffithii; 7031: fastigiata; 7065: Griffithii; 7515a: grata; 7552: syzygioides; 7619: pachyphylla; 7623: polyantha; 7661, 7679: syzygioides; 7750: fastigiata; 7751: Curtisii var. Holttumii; 7796: pseudosubtilis var. montana; 7843: Dyeriana; 7950: filiformis var. clavimyrtus; 7972: fastigiata; 7988: Griffithii; 8040: leptostemon; 8128: nigricans; 8261: variolosa; 8262: Griffithii; 8264: Cumingiana; 8277: chlorantha; 8278: filiformis var. clavimyrtus; 8376: longiflora; 8536: Scortechinii; 8864: longiflora; 8866: microcalyx; 8971: pustulata; 8987: longiflora; 9021: anisosepala; 9036: oblata; 9355: filiformis; 9519: Cumingiana; 9563: Watsoniana; 9632: subdecussata var. montana; 9681: Dyeriana; 9717: pallidula; 9755:

Cumingiana; 9758: filiformis var. clavimyrthus; 9788: virens; 9799: papillosa; 10146: grandis; 10208: glauca var. pseudoglaucâ; 10233: microcalyx; 10236: grandis; 10246: anisosepala; 10350: polyantha; 10641: Duthieana; 10661: polyantha; 10666: papillosa; 10785: Duthieana; 10792: claviflora; 10841: variolosa; 11013: pendens; 11049: leptostemon; 11274: filiformis; 11575: cerasiformis; 11603: claviflora var. excavata; 11777: syzygioides; 11792, 11798: Koordersiana; 11062, 12112: Dyeriana; 12139: pseudosubtilis; 12403: syzygioides; 12411: rhamphiphylla; 12421: syzygioides; 12425: Helferi; 12474: attenuata; 12484: subdecussata; 12486: pseudosubtilis; 12776: linocierioidea; 12779: Griffithii; 12783: Cumingiana; 12794: Duthieana; 12853: polyantha; 12860: Haniffii; 12872: subdecussata var. montana; 12961: pseudosubtilis; 13023: polita; 13025: Griffithii; 13036: attenuata; 13051: papillosa; 13211: inophylla; 13383: Haniffii; 13444: densiflora; 13615: leptostemon; 13663: densiflora; 13681, 13685: tumida; 13992, 13993, 14506: Griffithii; 14685: filiformis; 14721: Symingtoniana; 14820: tumida; 14960: Ridleyi; 14976: pallidula; 15071: rugosa; 15112: Griffithii; 15132: chlorantha; 15204: grandis; 15308: filiformis var. clavimyrthus; 15417: longiflora; 15421: Burkilliana var. garcinifolioides; 15602: fusticulifera; 15607: leucoxylon; 15696: subdecussata; 15700: longiflora; 15719: grandis; 16417: chlorantha; 16440: longiflora; 16502: pendens; 16509: fastigiata; 16534: pseudoformosa; 16886: densiflora; 17095: polyantha; 17104: Curtisii var. minor; 17157: fusticulifera; 17168: cerina var. turbinata; 17465: Bernardi; 17473: microcalyx; 17564: Dyeriana; 17708: Ridleyi; 17739: syzygioides; 17757: polyantha; 17768: Ridleyi; 17786: longiflora; 17859: Dyeriana; 17917: laevicaulis; 17928: grata; 17932: polita; 17939: chlorantha; 18010: Dyeriana; 18030: polyantha; 18242: papillosa; 18958: chlorantha; 19857: longiflora; 20117: Dyeriana; 20220: grandis; 20229: cerasiformis; 20231: grata; 20255: Dyeriana; 20305: tumida; 20405: jasminifolia; 20465: pseudosubtilis; 20493: valdevenosa; 20672: polyantha; 20780: claviflora; 20794: fastigiata; 20806: Bernardi; 21497: syzygioides; 21530: grata; 22299: densiflora; 22335: Wrayi; 22390: valdevenosa; 22422, 22446: subdecussata var. montana; 22477: leptostemon; 22497: caudata; 22537: cerina var. montana; 22570: ?napiformis; 22928: Watsoniana; 22937: fastigiata; 23134: densiflora; 23149: papillosa; 23330, 23364: tumida; 23397: valdevenosa; 23413: leptostemon;

23707: ?napiformis; 23782: pustulata; 23886: Wrayi; 24147: attenuata; 24620: cerina; 24633: filiformis; 25795: jasminifolia; 25812: variolosa; 25893: subdecussata var. montana; 25920: cerina var. montana; 25941: Wrayi; 26723: Symingtoniana; 26763: densiflora var. angustifolia; 26824: palembanica; 26910: jasminifolia; 26994: leucoxylin; 27109: rugosa var. cordata; 27110: oreophila; 27135: tetraptera; 27151: cerina; 27245, 27246: filiformis; 27309: nitidula; 27365: chlorantha; 27553: Bernardi; 27580: valdevenosa; 28055: Symingtoniana; 28109: gonio-calyx; 28233, 28335: jasminifolia; 28360: valdevenosa; 28536: claviflora var. excavata; 28973: chlorantha; 29093: pseudosubtilis; 29095: grandis; 29353: Bernardi; 29486: subdecussata var. montana; 29488: Stapfiana; 29490: oreophila; 29791: tetraptera; 29803: linoceroidea; 29856: caudata; 29863: claviflora var. excavata; 30689: grandis; 30764: chlorantha; 30791: Scortechinii var. cuneata; 30889: claviflora var. excavata; 31010: nitidula; 31018: tetraptera var. pseudotetraptera; 31025: Cumingiana; 31026: Dyeriana; 31447: Wrayi; 31448, 31449: oreophila; 31482: subdecussata var. montana; 31516: Duthieana; 32103, 32215: Stapfiana; 33041: pergamentacea; 33068: grata; 33093: grandis; 33202, 33205: attenuata; 33225: grata; 33413: ?malayana; 33502: grandis; 33655: filiformis; 33727, 33728: variolosa; 33754: pseudocrenulata; 33798: filiformis; 34016: gonio-calyx; 34227: scalarinervis; 35755: spicata var. tenuiramis; 36134: oreophila; 36220, 36238: subdecussata var. montana; 36265: tetraptera var. pseudotetraptera; 36271: Dyeriana; 36292: attenuata; 36518, 36552: Wrayi; 36564: Stapfiana; 36569: Wrayi; 37445: attenuata; 37541: densiflora var. angustifolia; 37692: rugosa var. cordata; 37696: Stapfiana; 37720: rugosa var. cordata; 37751: jasminifolia; 37768, 37787: subdecussata var. montana; 37824, 37847: claviflora var. Maingayi; 38104: grandis; 39209, 39264: pendens; 39358: leptostemon; 39400: attenuata; 40708, 40709: pendens; 41651: papillosa; 41652: cerina var. turbinata; 41703: papillosa; 42889: tahanensis; 42944: salictoides; 43135: syzygioides; 43167: grandis; 43208: spicata; 43328: syzygioides; 43330: longiflora; 43578: syzygioides; 43588, 43643: grata; 43729: papillosa; 43732: perakensis; 43744: oblata; 43746, 44010: operculata; 44033: setosa; 44056: attenuata; 44060: cerina var. turbinata; 44066: oblata; 45413: tetraptera var. pseudotetraptera; 47141: attenuata.

FOX—32: Cumini; 11290: Muelleri; 12576: cerasiformis;  
12726: microcalyx.

FOX'S COLLECTOR—12576, 12684: oblata.

FRANCK—352: Muelleri.

GOODENOUGH—114: densiflora; 445: chlorantha; 1643:  
palembanica; 1649: avenis; 1673: spicata; 1743:  
filiformis; 1759: Goodenovii; 1872: papillosa; 1985:  
subdecussata; 3829: papillosa; 4974: densiflora; 4975:  
leptostemon; 4978, 4978a: longiflora; 4987: pseudosub-  
tilis; 5072: densiflora; 10604: Dyeriana.

GRIFFITH (Kew Distribution ("K.D.") numbers. See note  
under Maingay)—2349: pendens; 2366: claviflora;  
2368, 2369: grandis; 2369, 2370: palembanica; 2371:  
pachyphylla; 2375: Griffithii; 2376: palembanica;  
2380: anisosepala; 2385: chlorantha; 2389: filiformis;  
2390: longiflora; 2391: syzygioides; 2395: polyantha;  
2405: Muelleri; 2410, 2411: microcalyx; 2416: glauca.

GWYNNE-VAUGHAN—356: pachyphylla; 612: oblata.

HANIFF—3915: Wrayi; 15483: grata.

HARVEY—21: tumida; 4994: tumida.

HENDERSON—1266: pustulata.

HOLMBERG—675: polyantha; 721: longiflora; 729: spicata;  
782: tumida; 793: papillosa; 859: polita; 873:  
papillosa.

HOLTUM—3: ?rhomboidea; 58: cerina var. montana; 98:  
claviflora var. montana.

HULLETT—134: filiformis; 165: densiflora; 194: polyantha;  
240: syzygioides; 316: filiformis; 339: palembanica;  
346: inophylla; 400: subdecussata; 403: Muelleri;  
465: inophylla; 533: spicata; 631: Muelleri; 638:  
syzygioides; 780: claviflora var. Maingayi; 805:  
subdecussata; 806: palembanica; 812: syzygioides;  
814: grandis; 848: Duthieana; 848: polyantha.

KERR—17128: microcalyx var. irregularis; 21754:  
pseudosubtilis.

KLOSS—25: Klossii; 103: leucoxydon.

KRUKOFF—3304, 4390: valdevenosa.

KUNSTLER (*King's collector* of some works)—18: longiflora;  
713: leptostemon; 737: valdevenosa; 738: densiflora;  
1172: Cumini; 1184: tumida; 1277: chlorantha; 1326:  
longiflora; 1368: attenuata; 1579: valdevenosa; 1771:  
oblata; 1793: pseudosubtilis; 1803: cerasiformis; 1863:  
tecta; 1901: chloroleuca; 1908, 2150, 2317: leptoste-  
mon; 2321: filiformis var. clavimyrtilus; 2605:

fastigiata; 2686: pseudomollis; 2737: valdevenosa; 2796: variolosa; 2808: pseudomollis; 2813: papillosa; 2842: valdevenosa; 3310: Kunstleri; 3345: leptostemon; 3348: Scortechinii; 3349: Dyeriana; 3401: pseudoformosa; 3407: Hoseana; 3410: napiformis; 3415: variolosa; 3422: pseudosyzygioides; 3475: cerina; 3491: Dyeriana; 3526: Pearsoniana; 3573: Dyeriana; 3654: caudata; 3680: Kunstleri; 3724: pustulata; 3752: subdecussata; 3782: cerina; 3966: Duthieana; 3995: variolosa; 4076, 4082: chlorantha; 4086, 4094: longiflora; 4132: fastigiata; 4181: Helferi; 4218: Duthieana; 4220: chlorantha; 4241: caudata; 4262: leptostemon; 4331: Cumingiana; 4346: cerasiformis; 4355: densiflora; 4405: longiflora; 4515: cerasiformis; 4541: garcinifolia; 4580: linocier-oidea; 4674: spicata; 4682: densiflora; 4719: Burkilliana; 4734: Scortechinii; 4735: Cumingiana; 4741: inophylla; 4769: subdecussata; 4947: valdevenosa; 4951: chloroleuca; 5122: valdevenosa; 5163: subdecussata; 5208: syzygioides; 5266: setosa; 5298: Dyeriana; 5309: Prainiana; 5322: valdevenosa; 5354: subdecussata; 5389: pseudoformosa; 5407: fastigiata; 5414, 5433: grata; 5447: setosa; 5483: cerasiformis; 5512: fastigiata; 5547: quadrata; 5572: pseudomollis; 5595: perakensis; 5601: filiformis; 5618: chlorantha; 5641: fastigiata; 5651: napiformis; 5721: densiflora; 5780: polita; 5822: fastigiata; 5855: densiflora; 5861: filiformis; 5868: densiflora; 5869: papillosa; 5904: spicata; 5925: filiformis var. clavimirtus; 5982: Griffithii; 5986: microcalyx; 5988: longiflora; 5989: Griffithii; 5990: microcalyx; 5994: camptophylla; 6012: oblongifolia; 6036: variolosa; 6079: inophylla; 6090: Griffithii; 6114: Hemsleyana; 6149: Curtisii; 6186: Burkilliana; 6192: Griffithii; 6196: Dyeriana; 6202: setosa; 6208, 6233: Koordersiana; 6254: pseudoformosa; 6262: caudata; 6267: grata; 6268: Duthieana; 6385: Koordersiana; 6404: Dyeriana; 6462: cerina; 6555: inophylla; 6581: polyantha; 6584: Prainiana; 6600: leptostemon; 6601: setosa; 6611: cerina; 6614: polyantha; 6627: pseudosubtilis; 6665, 6682: leptostemon; 6708: filiformis var. clavimirtus; 6743: longiflora; 6758: pustulata; 6759: napiformis; 6765: chlorantha; 6767: Dyeriana; 6793: setosa; 6822: Dyeriana; 6930: polita; 6937: cerina; 6946: pseudosubtilis; 6965: rugosa; 6974: garcinifolia; 6997: Dyeriana; 7003: valdevenosa; 7055: cerasiformis; 7065: densiflora; 7216: spicata; 7306: Benjamina;

7307: chloroleuca; 7315: polyantha; 7440: claviflora var. excavata; 7470, 7511: chlorantha; 7536: pustulata; 7563: Gageana; 7590: Swettenhamiana; 7669: Dyeriana; 7801: Scortechinii; 7811: Dyeriana; 7886: tumida; 7907: subdecussata; 7930: linocieroidea; 8030: subdecussata var. montana; 8094: linocieroidea; 8099: polyantha; 8102: densiflora; 8118: subdecussata; 8129: pseudosubtilis; 8200: scalarinervis; 8379: taipirgensis; 8387: pseudomollis; 8409: subdecussata; 8475: papillosa; 8481: inophylla; 8535: chlorantha; 8549: longiflora; 8609: fastigiata; 8633: polyantha; 8679: polita; 8697: Hemsleyana; 8700: microcalyx; 8741: Goodenovii; 8755: longiflora; 8848: oblongifolia; 10042: Griffithii; 10076: Scortechinii; 10086: polyantha; 10246: valdevenosa; 10417: pseudosubtilis; 10437: Scortechinii; 10472: fastigiata; 10521: castanea; 10648: polyantha; 10677: leptostemon; 10735: pseudosubtilis; 10752: subdecussata; 10780: leptostemon; 10873: valdevenosa; 10883: oblongifolia; 10940: densiflora; 10995: tumida.

KURZ—2933: spicata.

LAKE & KELSALL—4076: claviflora var. montana; 4078: polita.

MAINGAY (Kew Distribution numbers ("K.D.") are given, as these are quoted in most works in preference to the collector's own numbers. The same K.D. number was sometimes given to more than one collection and therefore occasionally to more than one species. In such cases Maingay's own numbers are added)—718: spicata; 719: Muelleri (*Maingay 1410 & 1411*); 720: longiflora; 721: filiformis; 722: syzygioides; 723: grandis (*Maingay 1682*); 723: valdevenosa (*Maingay 1682a*); 724: syzygioides (*Maingay 1412a & 1412b*); 725: palembanica; 727: microcalyx; 728: polyantha; 729: Ridleyi; 730: grandis (*Maingay 1416a & 1416b*); 731: microcalyx (*Maingay 1235 & 3058*); 732: grandis; 733: chlorantha; 736: Scortechinii; 737: papillosa; 739: pseudocrenulata; 740: subdecussata; 741: Muelleri; 742: pachyphylla; 743: virens; 744: attenuata; 745: conglomerata; 746: oblongifolia; 747: pendens; 749: subdecussata; 750: claviflora var. Maingayi; 751: pustulata; 753: anisosepala (*Maingay 1558*); 753: laevicaulis (*Maingay 3012*); 754: Griffithii; 755: tumida; 757: grandis; 758, 760: densiflora; 762: valdevenosa; 770: fastigiata.

MURTON—98: claviflora; 105: pseudosubtilis.

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GREGARIOUS FLOWERING OF THE TERRESTRIAL  
ORCHID *BROMHEADIA FINLAYSONIANA*

By R. E. HOLTUM

It is well known that certain epiphytic orchids flower gregariously. Several authors have made detailed observations of the behaviour of the species *Dendrobium crumenatum*, which is one of the commonest orchids in Malaya, occurring on nearly every old tree and producing a beautiful but short-lived display of fragrant white flowers several times during the year. Other less common species of *Dendrobium* behave similarly. The flower buds of these plants develop underneath their protecting bracts to a stage at which all parts are formed, and then rest, sometimes for some weeks, before entering upon their final period of growth, which ends in flowering after a definite number of days. The stimulus which causes the buds to resume growth appears to be an unusually prolonged cool period, of a temperature comparable to that of normal night temperature. The literature concerned is fully cited by Kerling (1941).

Other orchids besides *Dendrobiums* behave in this way (and indeed the phenomenon is not confined to orchids, as the behaviour of *Zephyranthes*, investigated by Kerling, is essentially similar). The species *Bromheadia alticola*, belonging to a rather isolated and peculiar genus of Western Malaysia, has an elongating inflorescence of conspicuous 2-ranked bracts, which thus appears very different from that of *Dendrobium crumenatum*, but its flower-buds rest in a similar manner and respond to cool temperature in the same way, opening their flowers a day before *D. crumenatum*. There is a very common terrestrial species of *Bromheadia* which has indications of a gregarious flowering, but its behaviour is so different from that of the

other orchids already mentioned that I was doubtful if it could be a response to the same kind of stimulus. The results of my investigations of this terrestrial *Bromheadia* are here reported, and they are interesting as indicating a behaviour mid-way between uninhibited flowering and the peculiar condition of *Dendrobium crumenatum*.

*Bromheadia finlaysoniana* is very common in the scrubby vegetation which develops in Singapore on land that has been cleared and abandoned. It grows in association with *Gleichenia*, *Nepenthes*, *Gahnia tristis*, *Melastoma*, *Wormia suffruticosa* etc. The soil is often a hard compacted clay and it takes a considerable time for a vegetation of trees to develop. The plants of the long-persistent scrub are exposed to full sun, and most of them have tough leaves. The roots of the *Bromheadia* are close to the surface of the soil, so that they must soon feel the effect of dry weather, though they are protected by the shade of the other plants around them. A week without rain in Singapore is a dry period; two weeks is very dry; three weeks very rare. A few days without rain under the tropic sun are a strain on most plants which have not a deep soil to supply their roots with water.

Plants of *Bromheadia finlaysoniana* have erect leafy stems two or three feet high, with a terminal inflorescence. The floral bracts alternate in close succession, and the inflorescence continues to elongate for several months; its tip commonly bears three flower buds at different stages of development (Fig. 1). Each bud takes 20–30 days to flowering from the time when it is first visible beyond its bract; the interval between the times of opening of successive buds varies considerably. Each flower lasts one day only.

If the inflorescences and their buds on all the plants continued to grow at a uniform rate, one would expect a random flowering, with no great differences in the number of flowers to be seen on different days. But when we grew a number of *Bromheadia* plants together in one bed at the Botanic Gardens, we found that at irregular intervals of about 6–12 days there were a considerable number of flowers open together (the number varying much on different occasions) with few flowers on other days. It seemed that there was some influence at work causing gregarious flowering of an irregular nature, even though all buds appeared to be developing continuously. In order to understand the matter better, I measured the lengths of buds on selected inflorescences daily over a period of several months. I did this in 1940, the plants measured being grown in pots

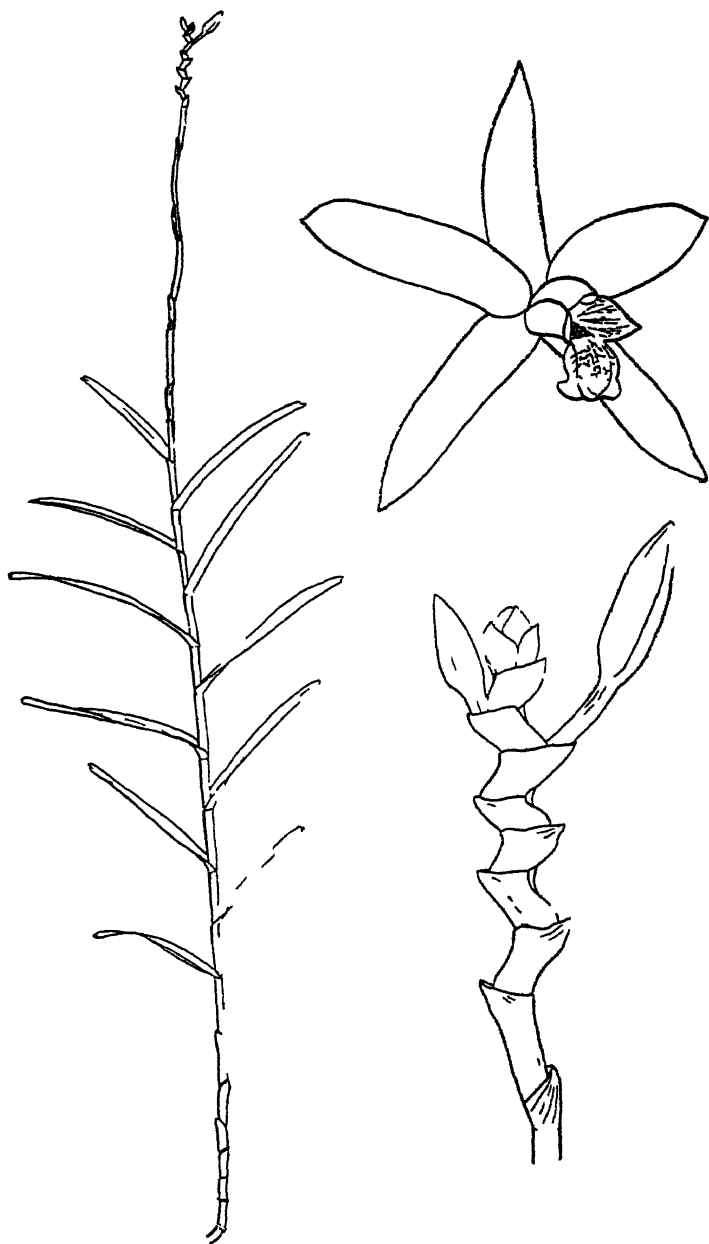


Fig. 1. On left, one complete stem of *B. finlaysoniana*,  $\times \frac{1}{4}$ . On right, inflorescence with 3 flower-buds at different stages ( $\times 2$ ) and an open flower ( $\times 1$ ).

and watered daily (except as noted below) and again in 1948 on some plants growing in a bed and receiving no water except rain.

In 1940 I measured 32 buds from their earliest visible stage to flowering, on five inflorescences (a few other buds fell prematurely). The time of development varied from 20 to 30 days, the mean time for buds on separate inflorescences varying from 24.5 to 25.5 days. The measurements were made to the nearest half millimetre, and included the total length of the bud with its ovary and short pedicel. Each bud showed an accelerated rate of growth, with a maximum on the last day, in which the increase in length was usually more than a centimetre. The measurements of 1948 gave similar results. In all, seventy-one flowers were measured over their complete development, on six inflorescences. The extreme periods of development were 19 and 34 days, the mean was 24 days.

When measurements of length of individual buds were plotted graphically, it was seen that some of them formed an even curve, showing a steady acceleration, while others showed retardation in part of the curve. The retardation usually occurred at lengths of 13 to 20 mm., and sooner or later gave way to normal accelerated growth for the six days prior to opening of the flower. It is thus evident that if several buds with retarded growth resumed normal accelerated growth at the same time, they might all flower simultaneously. In this way, buds which started to grow on different days might flower together (fig. 2). There can be no doubt that such retardation and subsequent resumption of normal growth is the cause of the gregarious flowering.

Two questions now arise. What causes the retardation of normal accelerated growth? And what causes the resumption of such growth after retardation?

My observations lead to the conclusion that there is not one single cause of retardation, and there is need of much further investigation before the matter can be fully understood. The following facts have a bearing on the matter.

In 1940, a potted plant under observation had its roots much exposed, owing to wash from heavy rain. I thought to help the plant by adding a little burnt earth (the usual potting soil) to cover the exposed roots, but this had a contrary effect. The plant (which had only one inflorescence) responded in a remarkable way. A flower-bud, which had attained 15 mm. in length and was developing normally, ceased growth on the day after the extra earth was added, and made no further growth, persisting 22 days before falling. A smaller bud, 5 mm. long, ceased growth and fell after only one day. This is clear evidence of a

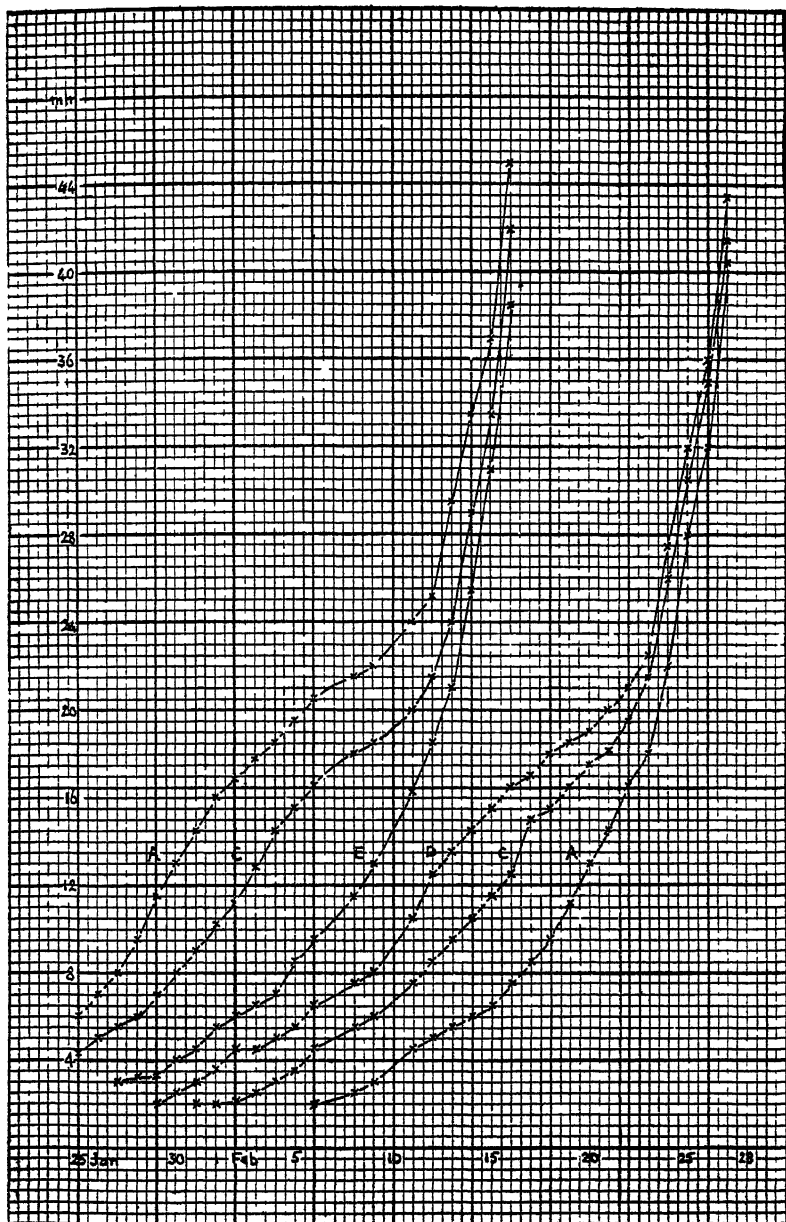


Fig 2 Graphs showing growth of six flower-buds to the day before flowering. The left-hand group flowered on 17th February, the right-hand group on 28th February. Letters refer to the inflorescences on which the buds were borne, the first and last of the six buds were both on inflorescence A.

close association between root activity and flower-bud development. The roots were evidently injured in some way by the added earth; whether merely by depriving them of necessary exposure to the air, or by some directly harmful chemical effect.

Another pot was moved to a place where it was sheltered from rain (in good bright light, but not direct sunlight) and watering was stopped for 14 days. At the time watering ceased, 9 buds were developing. Of these, the four largest (one on each inflorescence) all flowered normally 2-7 days later. Two others, which were 5.0 and 5.5 mm. long when watering was stopped, grew to full development but failed to open; their final accelerated phase was less steep than normal, and their final size about two-thirds normal. A bud 4 mm. long grew about normally to 13 mm., and then grew less than another millimetre in five days, after which watering was resumed and normal accelerated growth to flowering occurred. A bud only 1.5 mm. long grew normally to 4 mm., remained at about this length for five days, and then resumed normal growth when watering was started again. There is no doubt that lack of water can cause retardation of growth, but also that accelerated growth (though of reduced amount) can occur even if water is seriously deficient.

In 1948 the plants were in a close group in the open ground, and were not watered. The month of February, 1948 was very wet throughout. Yet a number of buds showed retarded growth. It is well known that orchid plants resent unduly wet conditions (which prevent normal aeration of the roots) and I can only suppose that undue wet causes upset of normal root functions with consequent effect on flower buds. But this matter needs more experimental investigation. Retardation at later periods occurred in dry weather, but not always. The effect of drought on the root is not to be measured merely in terms of rainfall or its lack; it depends on many other factors, such as wind, atmospheric humidity, and duration of bright sunlight, and is difficult to assess.

Our other question seems to have a more definite answer. I have found that on every occasion when a considerable number of flowers were open on the same day (12 flowers or more, on about 30 inflorescences) the seventh day previous was decidedly cooler than average as judged by a thermograph record. I have not made any definite measurements of these records. Something more is needed than a comparison of maximum temperature, which may be of short duration. There was sometimes a sudden cooling due to a storm, such as that mentioned by Coster (1926),

but not always, and sudden cooling is certainly not essential. The results agree with those of Kerling already mentioned for *Zephyranthes* and *Dendrobium*.

It seems then that flower-buds of *Bromheadia finlaysoniana* grow to about 12 mm. in length, and then for the next week or so are susceptible to retarding influences which may extend over a period of as much as eight days but usually over a lesser period. When the plant experiences the next unusually cool day, the normal accelerated development begins, and flowering occurs on the seventh day. Under normal conditions, the retardation does not amount to a cessation of growth, but such might occur (as in the unwatered pot) under exceptionally dry conditions.

It is not a big step from such a condition to that of *Dendrobium crumenatum*, in which growth ceases altogether at a certain stage of development, to be resumed as a result of a cool-temperature stimulus. The significance of the cool temperature stimulus probably is that such temperatures are usually associated with wet days; and water is necessary for the rapid later stages of development of flower-buds. (In *Zephyranthes* it has been shown that both cool temperature and water are necessary as a stimulus to growth of dormant flower-buds). The terrestrial *Bromheadia* is somewhat better off as regards water supply than the epiphytic *Dendrobium*, so that a total cessation of growth of buds until rain comes may be unnecessary. The *Bromheadia* is evidently also sensitive to a less pronounced cool-temperature stimulus.

All other species of *Bromheadia* except one are epiphytic, and it seems possible that *B. finlaysoniana* is "secondarily" terrestrial; i.e. that it is derived from epiphytic ancestors. Its roots are of epiphytic type. Whether under such circumstances its behaviour as regards bud-development could be a regression from the epiphytic condition (shown by *B. alticola*) or whether it is an arrested stage of evolution, is an interesting matter for speculation.

Some buds of *Bromheadia finlaysoniana* develop quite evenly, with no trace of retardation. Whether a bud always does this if root conditions are satisfactory, or whether such buds always experience a cool day at the right stage of their development, is a matter for further observation. The whole behaviour of flowering in this species is an indication of extreme sensitiveness to external conditions, and is an interesting example of how plants in our apparently very uniform climate can respond to small climatic changes.

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## THE SELECTION OF TYPE-SPECIES OF SOME OLD GENERA OF FERNS

*By* R. E. HOLTUM

Some early genera of ferns are so heterogeneous that the authors cannot have had clear ideas in founding them. It is sometimes possible to exclude certain species as not conforming to the author's generic description, but it is often not possible to say that one species rather than another is clearly indicated by that description. The generic description is thus not an infallible guide in the selection of a type-species.

The usual procedure has been to follow the first author who divides a genus. The process may be repeated more than once. Often the authors who split genera did not indicate a type-species; one can only agree that the type-species must be contained in that part of the original genus which is retained under the original generic name.

It may occur that subsequent authors in dividing a genus do not pay attention to the original generic description, and so may retain under the original generic name a species that does not well agree with that description, removing all others to another genus or genera. In such cases it may seem reasonable to select a new type-species of the original genus. But if (as often happens) none of the original species correspond uniquely to the description, there may well be difference of opinion as to which species most nearly corresponds to it. The result will be confusion. I suggest that, in the interests of uniformity of nomenclature, it is better to follow the first divider of a genus, even though he may not select (by implication or otherwise) a type-species that most nearly corresponds to the original description. This may not be ideal arrangement; but in practice no ideal arrangement is possible, and I suggest that it is better to follow a definite rule rather than an indefinite one which will allow of differences of opinion and, as a result, confusion of nomenclature. On the other hand, there should certainly be a recommendation that a later author, in dividing a genus, should principally consider the generic description when selecting a type-species.

Linnean genera can be treated like any others, having regard to the convention that the species described in 1753 are associated with the generic descriptions of 1754, and to the rule that legitimate nomenclature begins in 1753 (art. 20).

I apply these principles to the names of certain fern genera as follows:

### 1. *Pteropsis* Desv. 1827.

This genus included five different genera, by modern standards. The species which most nearly agrees with the original generic description is *Pteropsis scolopendrina*, which is a *Vittaria* (an earlier genus). It is therefore reasonable to regard *Pteropsis* as a synonym of *Vittaria*, and this is actually the effect of the action of the botanists who have in succession removed from *Pteropsis* the following: *Drymoglossum* Presl (1836), *Paltonium* Presl (1849), *Eschatogramme* Trevisan (1851), *Ananthacorus* Und. & Maxon (1908). I see no reason why *Pteropsis piloselloides* should be chosen as type-species of *Pteropsis*. It does not well agree with the generic description, and after Presl separated it in 1836 no botanist appears to have restored it to *Pteropsis* until Underwood and Maxon in 1908.

### 2. *Trichomanes* Linn. 1753.

In *Species Plantarum* 1753 eleven species are included in this genus. The generic description of 1754 would apply equally to *T. crispum* and to *T. scandens*, and there is nothing in the publications of 1753 and 1754 which would indicate one rather than the other as type-species of the genus.

The 19th century botanists who subdivided *Trichomanes* all agreed in leaving in it *T. scandens* and its near allies. Moreover, these are admitted by Copeland to represent a primitive and unspecialized section of the genus *Trichomanes sens. lat.*

But Copeland in 1937 (*Philip. Journ. Sci.* 67: 51) proposed a new generic name *Vandenboschia* for *T. scandens* and its near allies, on the ground that the type-species of *Trichomanes* is *T. crispum*, which he considers to typify a genus distinct from *T. scandens*. The reason for the selection of *T. crispum* as type-species is that it was the first species described as *Trichomanes* by Linnaeus, in 1737. But legitimate botanical nomenclature begins in 1753, and there is nothing in the Rules which instructs us to refer to earlier literature. We are in fact referred to generic descriptions of 1754. It is true that in the case of *Trichomanes*, reference to an earlier work gives us a single original species of our genus. But it would not always do so; and the obligation to search all literature earlier than 1753 in order to find the first species in each genus as understood by Linnaeus in 1753 would not only add greatly to the present amount of purely bibliographical work of taxonomists; it would also present many new problems which

would allow of differences of opinion. The result would not be conducive to stability of nomenclature, and would involve the expenditure of much effort which would be better directed to the study of the plants themselves.

I therefore contend that the type-species of *Trichomanes* should be *T. scandens*, not *T. crispum*, and that the generic name *Vandenboschia* Copel. is superfluous.

### 3. *Belvisia* Mirbel 1802.

When originally describing this genus, Mirbel discussed its relation to *Blechnum*, to *Pteris* and to *Asplenium septentrionale*. All species included by Mirbel in his new genus, except *B. spicata*, had compound leaves, and from his discussion it is clear that he regarded *B. spicata* as an aberrant member of the genus. *B. spicata* is however the only species left in *Belvisia* after the other species have been removed to the older genera *Blechnum*, *Pteris* and *Asplenium*. Therefore, though it does not agree best with the generic description, I agree to accept it as the type-species of the genus.

As the name *Hymenolepis* Kaulf. is illegitimate, being a later homonym of *Hymenolepis* Cassini, *Belvisia* takes its place, being the next generic name in order of priority.

### 4. *Thelypteris* Schmidel 1762.

Copeland, in Gen. Fil. pp. 135-136, rejects *Thelypteris* on the ground that it was not validly published by Schmidel. Alston had previously commented as follows on this subject (Kew Bull. 1932: 309):

It has been argued (Mackenzie in Am. Fern Journ. XVII, 117-119) that Schmidel was making use of a uninomial nomenclature; this is clearly untrue, as he uses the name *Commelina* for three distinct species. That Schmidel regarded his names as generic is clear from p. 104 where he speaks of Micheli's genus *Sphaerocarpus*. That Schmidel considered his genera to be published is apparent from his proposal of a new genus (*Tegamum*, p. 67).

Copeland objects that Schmidel's name *Thelypteris non ramosa* distinguishes it "not from *Acrostichum* of Linnaeus but from the older *Thelypteris* which we know as *Pteridium*". Schmidel was in fact reviving a genus published by Ruppius in 1718. The two species in that genus were *T. dioscoridis* (= *Pteridium aquilinum*) and *T. palustris non ramosa*. Neither belongs to *Acrostichum*, and there was nothing wrong in Schmidel maintaining a genus for them; the fact that we now consider them to belong to two different genera is irrelevant. Schmidel

published a long description and an excellent plate. It is a better basis than that of many fern genera, and I consider it to be valid.

### 5. *Ctenopteris* (Blume) Kunze 1846.

The name *Ctenopteris* was published by Blume in 1828, in a conspectus of the sections of the genus *Polypodium*. The preceding section (*Goniophlebium*) is clearly indicated as such; but of *Ctenopteris* Blume remarks that it is sufficiently distinct to warrant separation as a genus. He does not however make the separation, nor use the name *Ctenopteris* when later describing the species concerned. It is clear therefore that he was in effect describing a section of *Polypodium*, not a new genus. The first author to take up Blume's name and to publish binomials under it was Kunze (*Bot. Zeit.* 4: 425. 1846). Kunze did not describe the genus, but referred to Blume's description, so validating *Ctenopteris* as a generic name.

Different authors would define differently the limits of *Ctenopteris*. In Blume's original list are species with both superficial and immersed sori; and one of the latter (*C. venulosa*, type also of *Cryptosorus* Fée) is chosen by Copeland as the type-species. It may be contended that there is no sharp distinction between *C. venulosa* and the genus *Prosaptia* Presl (1836). It is also clear that *Xiphopteris* Kaulf. (1820) is a closely allied genus which might not unnaturally be united to *Ctenopteris*. (J. Smith placed *Polypodium trichomanoides*, which is a *Xiphopteris*, in *Ctenopteris*).

I consider that, if *Ctenopteris*, *Prosaptia* and *Xiphopteris* are united, *Ctenopteris* is the most appropriate name, *Xiphopteris* and *Prosaptia* referring to special characters not shared by the whole group. I have therefore proposed the conservation of *Ctenopteris* to have precedence over *Xiphopteris* and *Prosaptia* whenever either of these is united to *Ctenopteris* as typified by *C. venulosa* (Bl.) Kunze.

## THE STATUS OF BOTANICAL LITERATURE PUBLISHED BEFORE 1753

By R. E. HOLTTUM and C. X. FURTADO

In a recent paper, Chatterjee (1) criticizes a contention by Furtado (2) that botanical literature published prior to 1753 should be regarded as invalid. In our opinion, Chatterjee omits certain relevant considerations, and a further statement on the subject is therefore desirable.

Chatterjee objects to the use of the term valid and its derivatives by Furtado, and also to certain other "unfamiliar" terms, but he does not mention that Furtado has defined the use of these terms (3, 4), nor does he seem aware of the inconsistent use of the terms valid, legitimate and their derivatives in the Rules. Chatterjee himself is not consistent in his use of these terms.

As an example of the confusion that exists, we may quote the following possible argument, using a strict verbal interpretation of the Rules. Under Art. 36, literature published prior to 1753 may be regarded as effectively published, and under Art. 20 legitimate botanical nomenclature begins with Linnaeus' *Species Plantarum* of 1753; then by the application of Art. 19 and Art. 37, names published before 1753 are illegitimate but validly published (not invalidly, as maintained by Chatterjee); therefore under Art. 61 many Linnean names (which it is the intention of Art. 20 to conserve) become unusable as homonyms.

Basic to all Furtado's work is an attempt to define necessary terms, so that the Rules shall not be ambiguous; he has further attempted to clarify the Rules by bringing together those Rules which deal with the same subject. Much argument about the Rules is due to the lack of clear thought about the use of the terms concerned, and to the lack of logical sequence in the present Rules.

Chatterjee does not mention that Furtado's paper (2) deals with generic names, nor does he mention those parts of Art. 20 and Art. 42 which deal with generic names. Art. 20 states that it is agreed to associate the generic names which appear in Linn. Sp. Pl. ed. 1 (1753) and ed. 2 (1762-63) with the first *subsequent* descriptions given under those names in Linn. Gen. Pl. ed. 5 (1754) and ed. 6 (1764). Art. 42 states that the generic names of Sp. Pl. ed. 1 and ed. 2 are treated as validly published in those works. If these statements are not intended to indicate that Linnean generic names are not validated by reference to literature

published before 1753, what do they mean? And if such a rule applies to Linnean generic names, surely it should apply also to other generic names.

Prior to the Vienna Congress, the rule about names was "each natural group of plants can bear in science but one valid designation, namely the most ancient, whether adopted or given by Linnaeus or since Linnaeus, provided it be consistent with the essential rules of nomenclature". For generic names, it was then customary to refer back to Linnaeus' *Genera Plantarum* of 1737; some botanists even thought that Tournefort's work should be made the starting point for them. It was the work of Otto Kuntze which showed the enormous changes that would result if an attempt were made to find the most ancient use of a name, and it was because of this that the Vienna Congress of 1905 passed the rule making Linnaeus' *Species Plantarum*, first edition, the starting point for names of genera as well as species.

We contend that it was the intention of the Vienna Congress to make 1753 a starting point, and to rule out of consideration everything before that for purposes of name-validation. The rules which the Congress made concerned generic names, because the concept of a genus, and many generic names, existed before 1753, whereas the bulk of binomial names for species did not exist before 1753. Therefore special rules for generic names were necessary. It was recognised that Linnaeus changed the application of many generic names (so that his own names are later homonyms), and it was intended to regularize the position and prevent further argument.

It is true that the Rules do not specifically say that literature prior to 1753 is invalid. But in fact almost all botanists of the 19th century (except Otto Kuntze and any who followed him) regarded 1753 as a starting point, and did not recognize references to pre-1753 literature as validating names. It was only in the present century that this practice began. Chatterjee states that Prain was the first modern author on East Asiatic botany to validate a binomial by reference to Rumphius; but if he refers to Prain's publication of the name *Sindora galedupa* he will find an excellent diagnosis in which *S. galedupa* is distinguished from all other members of the genus; it is this diagnosis which validates the name, and the case is totally unlike those of Burman's Index and Stickman's list, which merely refer to Rumphius without any discussion or diagnoses.

Furtado has shown (2) the appalling complications which can ensue if references to pre-1753 literature are regarded as validating names; this discussion again is not

mentioned by Chatterjee. We contend that the intention of Arts. 20, 42 and 44 is to prevent such complications. Chatterjee himself admits that the practice is undesirable, and proposes that future authors should be recommended to cease the practice. We should prefer to see the recommendation made into an explicit prohibition by a change in the Rules such as that already proposed by Furtado (4, p. 14).

Furtado contends (and this again Chatterjee does not mention) that reference to pre-1753 literature should have the same status as manuscript notes in herbaria, or as herbarium specimens; a name cannot be validated by reference to notes or specimens. It appears to us that Prain also adopted this attitude to the plate and description of Rumphius which he cited; he used them as evidence only, and did not regard his citation of Rumphius as by itself validating his name.

Now we come to the special case of the interpretation of Linnean names. This is of fundamental importance, and it is not properly discussed in the Rules. It has many difficulties, and there is great need for a clear statement of correct procedure. We believe that proposals for such a statement are now being prepared; they are long overdue. We cannot here fully discuss this complex problem, but we make the following observations.

As Chatterjee points out, the descriptions accompanying most Linnean names are not adequate to characterize the species concerned. They must be interpreted by consideration of the figures quoted by Linnaeus, and also by the specimens which Linnaeus had at that time in his herbarium, or which he saw in other herbaria. These figures and specimens (which Furtado (5) calls the syntypes of a Linnean species; one can speak similarly of the syntypes of a Linnean genus) explain to us what Linnaeus meant, and give his name a meaning. The name is valid (in Furtado's sense) because we agree to start nomenclature with Species Plantarum edition 1 of 1753, and for no other reason; Linnaeus explained his names (and therefore made them usable, or valid in a different sense) by quoting figures and referring (often implicitly) to specimens. The case of *Cyclamen indicum*, quoted by Chatterjee, in which the figures cited by Linnaeus are incomprehensible (and possibly inaccurate) and no specimens exist, shows how useless the process of "validation" by reference to ancient literature may be.

The principle of priority is not an end in itself. It is a means to an end, and the end is stability of nomenclature. Many early names cannot be typified with absolute certainty. Therefore botanists are apt to disagree about their typification, and stability is lost. We submit that Furtado's

interpretation of the intention of the Rules would eliminate the possibility of a great deal of fruitless argument about the status of ancient names, and thereby free botanists to attend to much-needed monographic work on the vast number of tropical plants which are still unknown or very imperfectly or even inaccurately described.

Old names must be given precise meaning by study of type specimens or by other means; otherwise their use leads to confusion. But if there is insufficient evidence for a precise typification of such names, we submit that it is much better to ignore them altogether. Unless the evidence is clear, there is room for argument, and to difference of interpretation, with resultant instability of nomenclature. It was to eliminate such uncertainty and instability that the present Rules about generic names were made. We believe that these rules should be more strictly defined in the sense proposed by Furtado, and that this would lead to a greater stability of nomenclature.

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# A FURTHER COMMENTARY ON THE RULES OF NOMENCLATURE

By C. X. FURTADO,  
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1. Introduction.
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3. Condensation in the Rules.
4. The Variety Typica.
5. Sub-divisionary and Disjunctive Groups.
6. Priority of the Names of Generic Sub-divisions.
7. Subspecies are Sub-divisionary Groups.
8. Specific Names and Infra-specific Descriptions.
9. Priority of Ternary and Sub-Ternary Names.
10. The Status of Formae and Subformae.
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24. "Binary" Names under an Invalid Genus.
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27. Responsibilities of Publishers.
28. Orthography of Names.
29. Tautonyms and Generic Homonyms.
30. Proposed Amendments to the Rules of Nomenclature.

## 1. Introduction

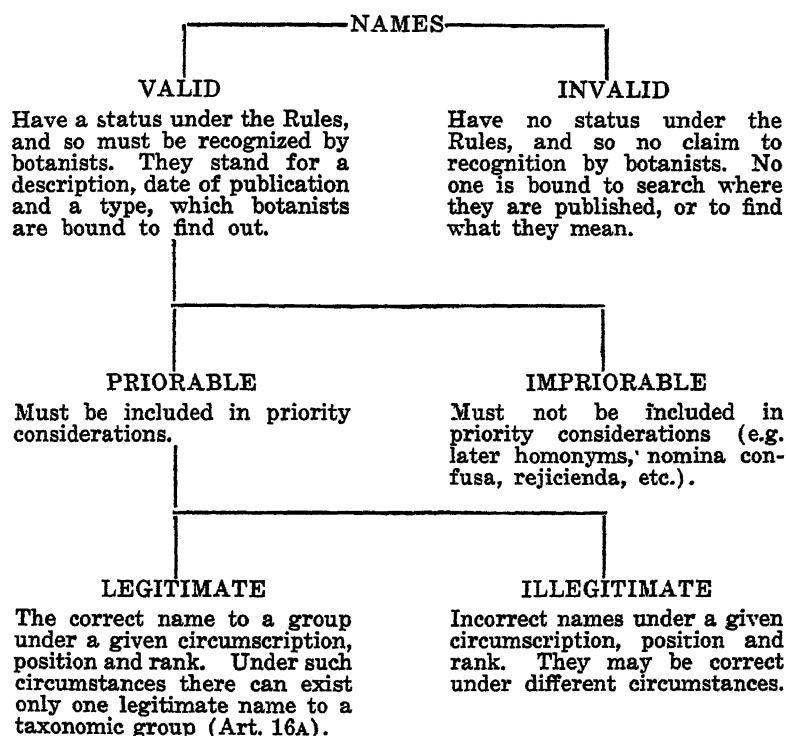
In my previous commentary on the laws of botanical nomenclature (Gard. Bull. Straits Settl. IX, 1937, pp. 223-284), an attempt was made to clarify a number of provisions which appeared vague or inconsistent in the 1935 Rules. Later some amendments were proposed by me for consideration at the 1940 Botanical Congress on points that appeared to me the most essential for future progress (Gard. Bull. Straits Settl. XI, 1939, pp. 1-30). However, I venture here to issue a complementary set of proposals and a commentary in the hope that the philosophical basis of nomenclature may receive due consideration in the revision of the Rules at the 1950 Congress. I submit that the time has come when botanists should pause to analyse first the principles involved in the system of the rules as a whole and then examine the different rules accordingly.

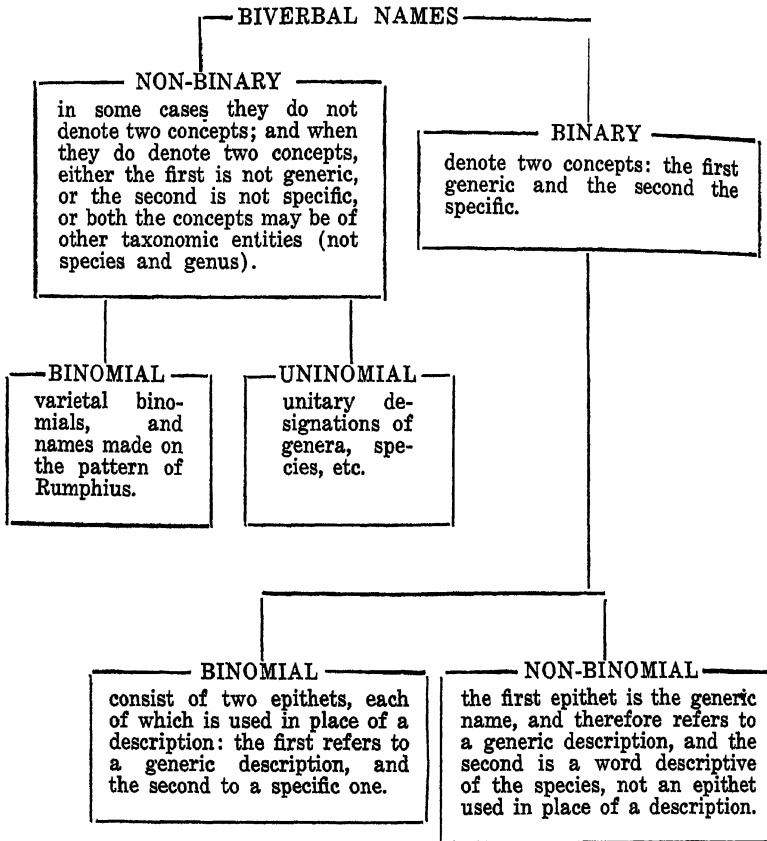
I propose therefore that a special Committee be appointed to consider in detail the principles involved. Should this Committee agree to a principle, but not to the location or the form of an amendment embodying the principle—two reasons why a good proposal may be rejected—the Committee should be empowered to suggest a better place and/or better wording so that the principle might be incorporated in the code.

## 2. Certain Elementary Distinctions

There is little objection to the use of a word in more than one sense, though fallacies may be lessened by using differential terms; but what is disastrous is that any word should change its sense during a discussion without our being aware of the change. In a code of rules, therefore, the multiplication of distinctions by proper definitions is essential in order to prevent the misapplication of the rules themselves. Thus, much confusion has been caused by the equivocal use of the terms *valid*, *legitimate* and their antonyms (Furtado in *Chronica Botanica* V, 1939, pp. 214-215, and in Gard. Bull. Straits Settl. XI, 1939, p. 24 and Arts. 2B, 16A, 19A and 61B), as well as in the use of the terms *binary*, *biverbal* and *binomial* (Furtado in *Philipp. Journ. Sc.* LXIX, 1939, pp. 467-469 and in *Bull. Jard. Bot. Buitenz.* XVI, 1939, pp. 116-119). As a result the entire legislative body has sometimes been misdirected at Botanical Congresses, leaving the taxonomist in uncertainty as to the application of certain rules which previously had been considered clear and straightforward (see also Furtado in *Philipp. Journ. Sc.* LXX, 1939 pp. 197-199).

In view of this I submit that the distinctions existing in the most elementary terms *binary*, *biverbal*, *binominal*, *valid*, *priorable*, and *legitimate* with their antonyms might be incorporated in the body of the Rules themselves. This will oblige botanists to consider these distinctions in applying the different provisions in the Rules. I append here a tabulated analysis so that the distinctions may be clearly borne in mind in appreciating the discussions and the proposals that follow.





### 3. Condensation in the Rules

In the 1935 Rules, provisions concerning a particular subject are unnecessarily scattered in different Sections and in different Chapters so that this diffusion has frequently confused even experienced nomenclaturists. To give an instance of the confusing way one has to wade through the Rules in order to find whether or not a name is correct. I quote the following from two acknowledged nomenclatural authorities:—

“*Abies taxifolia* Poir. was actually a new combination for *Pinus taxifolia* Lamb. (1803) non Salisb. (1796), and as such invalid, but as a new name it is valid under Art. 69, since Poiret was at liberty to adopt the epithet *taxifolia* although it had previously been given to the species in an illegitimate combination.” (Sprague and Green, The Botanical Name of the Douglas Fir, in Kew Bull., 1938 pp. 79–80).

That is, a name which was "actually a new combination" and "invalid" under one rule becomes "a new name" and "valid" under another. Yet we are told that "names and forms of nomenclature contrary to a rule (*illegitimate* names or forms) cannot be maintained." (Art. 2). Under this definition in Art. 2, therefore, *Abies taxifolia* Poir. should be considered illegitimate and unusable if the arguments brought forward by SPRAGUE and GREEN were accepted as correct. (Note also that the use of the word "valid" by SPRAGUE and GREEN is not in accordance with its definition in Art. 16). If this case were considered under the strict wording of Art. 54, another interpretation is possible, though overlooked by SPRAGUE and GREEN. Under this Article, it looks as if POIRET was obliged to adopt the epithet *taxifolia* when he transferred *Pinus taxifolia* Lamb. to *Abies*; for there was not available for the species an earlier validly published epithet, nor was the resulting combination a later homonym or a tautonym—the only two obstacles under which Art. 54 allows a different epithet to be used for a species when transferred from one genus to another (see also Furtado in Gard. Bull. Straits Settl. XI, 1939 p. 24 sub Art. 53A and in Fedde, Repertorium XLIV, 1938 p. 244–255).

In view of this misleading diffusion in the Rules, I plead again for a rearrangement so as to keep all the provisions pertaining to one particular subject together.

#### 4. The Variety Typica

A botanist who wishes to make one and the same specimen the basis of a species, variety, and subvariety at the same time, yet wants to keep the infra-specific epithets under the same binomial, will naturally (in this particular case) make our system polynary, polynomial and polyverbal, though only in form; for all such infra-specific epithets added to the biverbal specific name (a binary) would convey nothing more than the binomial as typified strictly by the type specimen (species *sensu stricto*). Further, a varietal name (which is ternary), when applied to the type of a species (a binary group), involves a contradiction in terms. I submit this systemic incompatibility as the principal reason why a formal trinomial given to the type of a species (species *sensu stricto*) cannot have a status under the Rules and so cannot be used in priority considerations. BOLLE (Notizbl. Bot. Gart. Berlin-Dahlem XIII, 1937 pp. 524–530 with an appendix by Harms, Mattfeld and Pilger) has

shown that serious complications arise by considering valid the infra-specific epithets conventionally adopted to indicate the species *sensu stricto*, their invalidity being also explained independently by me in Gard. Bull. Straits Settl. IX, 1937, pp. 242-244 (cf. also XI, 1939, pp. 19-20).

Nevertheless FOSBERG (Amer. Journ. Bot. XXVI, 1939, pp. 229-231) and CROIZAT (Journ. Arnold Arb. XXII, 1941, pp. 133-142) have scanned the misleading rule of "superfluous" names (cf. Discussion 15 below) and have come to the conclusion that "there is nothing in the rules which says that ordinary sub-divisional epithets shall not designate the typical sub-division." (Fosberg). In fact CROIZAT has created nomenclatural complications by applying the rule of priority to the varietal epithets given to the species var. *typica*. A name that contravenes a very fundamental principle in the nomenclatural system should be regarded as invalid (having no status under the Rules). There is no sense in scanning the provisions of legitimacy or priorability to find whether there is in them anything to prevent the use of such a name, as they are applied only to those names that are valid (have a status under the Rules).

Difficulties in understanding this principle arise when a botanist considers a species as a wide group to be subdivided into smaller groups (varieties). Horticulturists, by ignoring the type-concept, follow this system and make varieties their lowest autonomous units, the aim in horticulture being to name and describe the lowest variation. But, unlike horticulturists, the taxonomist not only accepts the type-concept but also makes the species the lowest autonomous unit, admitting varieties and subvarieties as subordinate groups only. The type-concept implies that the species *sensu stricto* (var. *typica*) be taken as the "standard" with which to compare the divergent elements. If the differences do not deserve a separate specific rank, then the elements are classified with the "standard", the differences being considered as minor. Should some of the minor differences be considered as meriting special attention, then the principal differing elements are named and characterized as deviations (varieties) from the type (species *sensu stricto*), while those differing from the type of the variety are named as subvarieties. The type form of the species itself does not receive any infra-binary name except a conventional epithet when one wishes to emphasise that the binary group should be interpreted strictly according to the type. In this connection it might not be out of place

to quote here the very apt remarks made on the subject by Prof. L. H. Bailey:

As employed by the writer, following Article 30, Recommendation 18, of the International Rules of Botanical Nomenclature, the epithet var. *typica* is not regarded as a new name, but as a parenthetical practical device to permit accurate designation of the typical element of a species. It has no nomenclatural standing and does not require the citation of an authority. Whenever a variety or a subspecies is described or placed in a species, the typical element of that species automatically becomes variety or subspecies *typica*. (Gent. Herb. IV, 1940, p. 292).

Here BAILEY is not considering the distinctions shown to exist between sub-divisionary and disjunctive groups (Discussions 5–8 below), a distinction which makes a variety always a ternary group even when there be a subspecific epithet preceding the varietal epithet; but the principle of var. *typica* is clearly indicated. It is also important to note here that the Rules as drafted at present admit varying interpretations so as to lead BAILEY to maintain a view quite opposed to that of FOSBERG and CROIZAT.

### 5. Sub-divisionary and Disjunctive Groups

False analogies seem to have played a good deal of influence in the modifications that have extended the application of special rules covering the names and descriptions of subspecies and of sub-divisions of genera, to the names and descriptions of other subordinate groups also. Thus, if epithets denoting a subspecies could be omitted in a "quadrinomial" so as to make the varietal name always a ternary trinomial, the analogy has been erroneously extended to the epithets denoting inferior groups so as to make it "permissible to reduce more complicated names to ternary combinations." (Art. 28). Because the description of a subspecies (or a section) can be referred to in validating a specific (or a generic) name, the descriptions of varieties, subvarieties, formae and subformae have been invested with the power to validate any group from a species downwards (Arts. 49 and 58). Since epithets denoting a subspecies have a priority right outside their own species, the same sort of right has been extended to epithets denoting generic sub-divisions outside their own genera (Arts. 53 and 56) and similarly to epithets denoting varieties and other inferior groups outside their own species (Arts. 55 and 56). Before assessing the need for making different sets of rules to cover these different groups, it would be advisable to pause a while to examine how

groups like a subgenus or section differ philosophically from groups like varieties and subvarieties, leaving the subspecies for a special discussion by itself.

Groups like subgenera, sections and sub-sections divide a superior group into *two* or more sub-divisions. There can never be only one sub-divisionary group under its immediately superior group; the existence of one such sub-division, therefore, implies the existence of at least another of the same rank and in the same position. Hence should there be only two sub-divisions under a group, the suppression or transference of one means also the death of the other. Only these kinds of groups are called here as *sub-divisionary*.

In this sense varieties and subvarieties are not sub-divisionary groups; they are subordinate groups of the *disjunctive* class, being minor *deviations* from the "standard" set by the type specimen (Discussion 4). It is possible to have only one such disjunctive deviation under a species or a variety. Sub-divisionary groups are established to classify previously well recognized entities of a different category, and so each sub-divisionary group must at least include one such entity in it; whereas a disjunctive group is created to show a newly recognized deviation from the standard and so is not a heading for grouping any other subordinate entities (see Discussion 12 below, where the species and genera are shown to belong to neither of these two categories).

In view of these differences there are no compelling reasons for subjecting the names of both these kinds of groups (sub-divisionary and disjunctive) to a uniform set of priority and other rules; on the contrary it is proposed to show below reasons for subjecting each kind to a different set of rules.

## 6. Priority of the Names of Generic Sub-divisions

Taxonomically, the sub-divisionary entities under a genus appear to be unstable and represent different attempts to classify the species with the view either to indicate their affinities or geographical distribution, or to facilitate their identification. Hence these infra-generic sub-divisionary groups vary in importance according to the basis and aims for which the sub-divisions are made. The orthodox practice is to allow priority to the names of infra-generic sub-divisionary groups only when the basis of the classification is the same; not otherwise, and never outside their own genus. Of course in the examples mentioned in Art. 53, the sectional name is retained outside its original genus; but

there are also numerous instances where such names are rejected because their retention, on the transfer or remodelling of the divisions, would cause serious complications both in nomenclature and in taxonomy. Thus GRIFFITH (1844 and 1850) divided *Calamus* into three sections:

*Section 1: PIPTOSPATHAE* Griff.: Only the lowermost spathe is persistent; others deciduous.

*Section 2: PLATYSPATHAE* Griff.: All the spathes persistent, tubular only (if at all) at base, expanded into a broad, loose lobe at the end.

*Section 3: COLEOSPATHAE* Griff.: All the spathes persistent, strictly tubular throughout, obliquely truncate at the end.

Subsequent botanists retained these sections only when the basis of their classification remained the same as GRIFFITH's. Thus, RIDLEY (Mat. Fl. Malayan Pen. II, 1907 p. 189-190) in dividing *Calamus* into sections on a different basis, was right in not retaining any of GRIFFITH's sectional names. RIDLEY divided his sections as follows:

*Section 1: MISCHANTHECTAE* Ridl.: Spadices flagellate, leaves not flagellate.

*Section 2: PHYLLANTHECTAE* Ridl.: Leaves flagellate, spadices not flagellate.

It is obvious that this aspect of the question has been overlooked in the Rules, and on false analogy the provisions applicable to the names of genera and species have been applied to the names of the sub-divisionary class also. No doubt we must avoid useless creation of names, whatever that phrase may mean (Art. 4); but any attempts to effect definiteness in the nomenclature of sub-divisionary groups where no such definiteness is obtainable in taxonomy, are likely to raise more difficulties than solve them. It is better to have more names and clear taxonomy than fewer names and confused taxonomy.

In the appended proposals therefore the rule in Art. 53 has been transformed into a recommendation to be applied whenever possible, and at the discretion of the botanist effecting the transfer of, or sub-dividing, the group.

## 7. Subspecies are Sub-divisionary Groups

As to the status of the subspecies, there are two widely divergent views current at present: the one regards the subspecies as a taxonomic group larger than, though of the same class as, a variety; the other considers the subspecies

as a sub-divisionary group, that is, a taxonomic device of the same nature, not of the same rank or position, as a section of a genus. In the latter sense a subspecies helps to classify the varieties occurring in very large, widely polymorphic groups called metrospecies, super-species, species complex, or species sensu amplissimo. In a stricter sense the subspecies could have been raised to a specific rank, but the intergrading variations do not allow a clear cut distinction; such groups are generally found in plants which have been cultivated extensively for a long time under different ecological or other conditions. This latter concept, which makes the subspecies a sub-divisionary group, is the older of the two and is one that seems to be widely current; it is also one that accords fully with many current nomenclatural procedures and, therefore, deserves to be adopted in the Rules.

Further, all the subspecific groups were at one time considered as good microspecies sensu stricto, and so subspecific names were admitted also as alternative specific names, the latter being formed by dropping out the specific epithet from the subspecific trinomial. It is because of this view that all subspecific names are registered as specific names in the early parts of *Index Kewensis*, and the practice has been long current to accept as valid all subspecific names even when published as binomials under a species. But in the Rules the status of subspecies has been confused with the disjunctive groups, as if a subspecies were merely a large variety. As a result of this confusion there has arisen a tendency to disregard subspecific names as good alternative specific names. Those alternative specific names that are current for subspecies have been taken as validly published in the nomenclators where they were first registered as binomials; it is overlooked that the compilers of nomenclators like *Index Kewensis* did not intend to create new specific names for subspecies, but recorded what sound practice then current obliged them to record. It is necessary to remove this confusion from the Rules. It seems desirable to legislate invalidating automatic alternative specific names to subspecies published after 1930.

## 8. Specific Names and Infra-Specific Descriptions

Since subspecies are microspecies based on characters co-ordinative with the species, it follows that reference to a subspecific description is sufficient to validate a species—a conclusion also defensible on the basis of a subspecies being a sub-division of a species (cf. generic names validated by

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referring to the descriptions of subgenera, sections and sub-sections which might be called microgenera). But on false analogy specific names have been allowed to be validated by referring to the descriptions based on subordinate characters of the disjunctive groups (Arts. 49 and 58). This practice (now legalised) forms at present the only reason for discouraging taxonomy of cultivated plants (see also Discussions 4 and 13). Under Arts. 49 and 58, infra-specific names, when abbreviated by non-taxonomists into biverbals, might have to be accepted as good specific names, though published in most unexpected places like nurserymen's seed-lists, lumbermen's journals, agricultural field experiment records, and catalogues of plant-products. Not only would such names burden systematists with useless, confusing synonymy, but would often necessitate name-changes because of their priority or homonymy. Another result of the provisions in Arts. 49 and 58 is to admit the use of binary names to infra-specific groups prohibited under Art. 28, for these horticultural binomials would be nothing more than binary names created by incompetent persons for the taxonomist's varieties, subvarieties, formae and subformae. (For further complications that this procedure would cause if the theory of implicit references were admitted as valid, see Discussion 25).

In view of this it seems necessary to change the terminology in Arts. 28, 30, 44, 49, 52, 55, 56 and 58, and to alter Arts. 49 and 58 so as to prohibit validation of specific names by reference to the descriptions of disjunctive and other subordinate groups.

## 9. Priority of Ternary and Sub-Ternary Names

On the mistaken belief that subspecies are merely subordinate groups analogous to varieties and subvarieties, the rule of priority has been uniformly applied to the epithets of all these groups. The epithets of varieties and subvarieties, like those of subspecies, have been thus invested with priority claims even outside their species and genus (cf. Arts. 55 and 56). One has only to try to straighten the nomenclature of the varieties of, say the Date, Wheat, Rye, Soya, Rose, Mustards, and Oranges, to realise the utter hopelessness of working out the nomenclature on these provisions. Added to this there is the difficulty of typifying the names of varieties, subvarieties and other subordinate groups, because these are based often on characters not identifiable in herbarium specimens, and also because often plant-geographical procedures are not applicable in typifying such names. The only practical solution

in such cases lies in limiting the priority of these names under their immediately superior groups and not to permit reduction of infra-ternary combinations except by removing the intercalating omissible epithets (subspecific epithets and var. *typica*). An amendment has therefore been proposed so that varietal epithets instated under one species may not have a priority claim outside that species.

## 10. The Status of Formæ and Subformæ

Formæ and subformæ fall outside the scope of alpha and omega taxonomy, though in economic botany these groups may be given a status similar to varieties. Their study leads one into the realms of physiology, horticulture, and genetics. It is evident that these groups have been admitted as special subjects of nomenclatural rules. Their nomenclature therefore should not be allowed to interfere with that of disjunctive taxonomic groups subordinate to a species. Reference to their descriptions should not be allowed to validate the names of any higher groups like varieties and species, nor of any groups outside their immediate superior group.

Further, formæ and subformæ may be distinguished even in the species, variety and subvariety (all sensu typico). Reducing them to ternary expressions when instated as infra-ternary groups will therefore confuse their identity; hence such reductions should not be permitted even when the intercalary epithet is that of a subspecies, unless the epithet is var. *typica* or its equivalent.

## 11. Reducibility of Infra-Ternary Names

It has already been shown that subspecies are subdivisions of a species complex and that the subspecific epithet may be omitted. Also the varietal epithets instated under subspecies may be joined directly to the binomial denoting the species sensu amplissimo. It has been shown further that this procedure cannot be extended to the epithets of non-subdivisionary groups (the epithet *typica* or its equivalent is a conventional device having no priority claim). Because of this permission to omit sub-divisionary epithets, *Erysimum hieraciifolium* subsp. *strictum* var. *longisiliquum* and *E. hieraciifolium* subsp. *pannonicum* var. *longisiliquum* (example given under Art. 30) form a pair of homonyms (*E. hieraciifolium* var. *longisiliquum*), one of which has to be rejected under Art. 61. Further as var. *typica* should have no status under the Rules, the name *Saxifraga Aizoon* var. *typica* forma *rubra* can be abbreviated into *S. Aizoon* forma *rubra*. But because such

"quadrinomials" can be abbreviated to trinomials, analogy cannot be extended to permit reduction of infra-varietal names to ternary combinations without causing serious confusions in nomenclature. The rule which permits the reduction of infra-ternary combinations should therefore be modified.

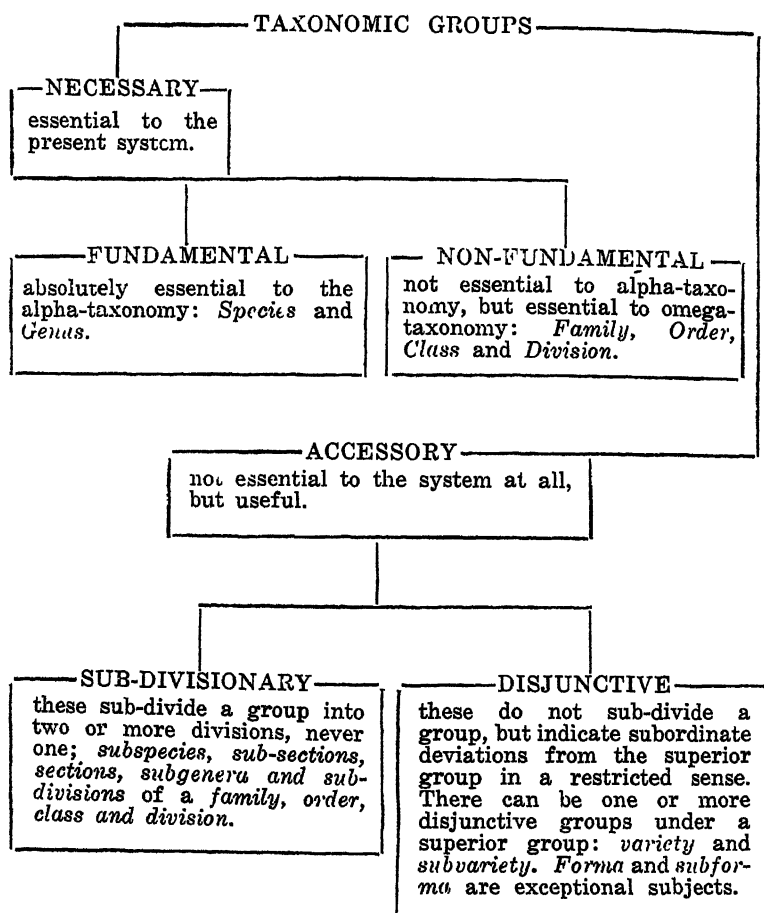
## 12. Philosophical Differences in Taxonomic Groups

In the foregoing Discussions, I have attempted to show that, in addition to differences in categories or ranks of taxonomic groups enumerated in Arts. 10-12 (which may be said to be phylogenetical), there is also a philosophical difference in these groups according to their nature, and their relationship to their immediately superior or inferior group. In order to bring out these differences, the taxonomic groups are here divided into *Necessary* and *Accessory* groups.

The *Necessary* groups are essential to the present system of nomenclature and taxonomy, and the existence of one implies the existence of all the others, both superior and inferior to the one mentioned; there need not be more than one *Necessary* group under a superior group. The *Necessary* groups are Species, Genus, Family, Order, Class and Division. Among these, the Species and the Genus are the only two which are absolutely essential to the binomial system of nomenclature, and so to the immediate aim of taxonomy (alpha taxonomy, as some botanists would call it), that is, to the naming of the distinguishable species in the vegetable kingdom; hence these are called the *Fundamental Necessary* groups. The remaining *Necessary* groups are not essential to alpha taxonomy and were introduced into the system much later than the *Fundamental Necessary* groups; but these *Non-Fundamental Necessary* groups are needed in order to achieve the more remote aim of taxonomy (omega taxonomy), namely, to understand the phylogeny of different species of plants, or their taxonomic affinities.

The *Accessory* groups, on the other hand, are useful to indicate the affinities of the inferior groups under a superior one; they are divided into two categories, the *Sub-divisionary* and the *Disjunctive*. The *Sub-divisionary* groups divide a group into *two* or more inferior ones, and so can never exist singly under an immediate superior group; subspecies and sub-divisions of a Genus, Family, Order, Class and Division fall into this category. The *Disjunctive* groups represent subordinate deviations (not co-ordinate) from an accepted unit or standard: they are varieties and subvarieties. *Formae* and *Subformae*, being of varying nature, and at present not well defined, are included as

special subjects of nomenclature. Their taxonomy lies outside the scope of alpha taxonomy, being a corridor into the realms of physiology, horticulture and genetics.



### 13. The Nomenclature of Hybrids and Cultivated Plants

From Arts. 10, 12, 28 and 35, it appears that the taxonomist generally regards the study of hybrids and of cultivated plants with suspicion; in fact it would seem from the wording of the Rules that these plants are precluded from being named botanically. However, an examination of the names of cereals, fruits, vegetables, ornamental and oil plants reveals the fact that plants derived from hybridisation, or known only in cultivation, were formerly considered as worthy subjects of botanical nomenclature;

their names, even if given after the 1930-35 Rules, are retained as valid. The wording of the above cited Articles seems therefore to have no value except to show that, in general, the taxonomy of non-feral plants is to be discouraged.

The first reason for this attitude is that such plants are usually studied, described, and even named in their own way, by agronomists, horticulturists, or nurserymen, who are often unfamiliar with botanical nomenclatural procedure. In many such cases, biverbal or binomial names in Latin are used. When descriptions in any romanised European language were admitted for instating a valid botanical name, there was a real danger of the botanical nomenclature of cultivated plants being burdened with a host of binomials based on biological, physiological, anatomical, horticultural and genetic distinctions. But now this danger has been removed by prescribing Latin for describing taxonomic groups of recent plants (except bacteria) after 1934.

The second reason for discouraging the taxonomy of cultivated plants is because of the procedure, now becoming popular, of instating specific binomials by referring to descriptions of varieties and infra-varietal groups. Under such a procedure all the abbreviations made of varietal and infra-varietal names by non-systematical workers would have to be accepted as valid specific names. If such a validation of specific names were prevented, there would be no justification for refusing to admit the plants of cultural and hybrid origin as normal subjects of nomenclature. (See Discussions 8 and 10).

#### 14. The Status of the Rules Regarding Hybrids

To many taxonomists Arts. 31-34 are a frequent source of confusion. If, for instance, at the time of giving a name to a species or a genus, its supposed hybrid origin is indicated and the putative parents mentioned, some taxonomists maintain that such a name would be a good nomenclatural entity, but not subject to the ordinary rules of nomenclature. Under this view the name would have to be associated not with the taxonomic group described, but with the putative parents. Should a subsequent botanist disagree with the alleged parentage and indicate different parents, then the nomenclaturists would change the name. This view would also permit validation of names in anticipation of actual production of hybrids (cf. *Colmanara* and *Hatcherara* in *Orch. Rev.* 1948, p. 145). The supporters of this view overlook the fact that the name is to be associated with the taxonomic

group represented by the type specimen and with its description, and not with the alleged or real ancestors (Arts. 15 and 18). Further a formula denoting a hybrid will include all the different phenotypes and genotypes produced in the successive filial generations and may consequently include also genotypes resembling one or both the parents. Therefore such formulas, although helpful to the geneticist as recording the history of his hybrids, will not help the taxonomist to identify the plants themselves. The formula is therefore not a substitute for a diagnosis. Moreover correct formulae are sometimes unusable for systematic purposes in the case where one of the putative parents has to be given the status of a variety, as is often the case when its putative hybrid offspring have already been given the rank of a species. Thus if C is a genotype derived from a cross between A and B, and differs only varietally from B, and if A and C have been named specifically earlier than B, then B can only be named nomenclaturally as a variety of C, even though the latter is genetically derivative from B. The formula  $A \times B = C$  cannot be accepted by systematists, when nomenclaturally B is a variety of C.

It is evident therefore that the object of Arts. 31-35 is to put some sort of order in non-botanical nomenclature of cultivated plants and hybrids, so that it may serve the purpose of communicating to the public the results obtained in applied botany in general. It was never intended to give non-technical names a status in botanical nomenclature. The plea that the earlier use of the formula *Juncus alpinus*  $\times$  *articulatus* is an obstacle to the use of *Juncus alpino-articulatus* is therefore based on a misconception (cf. Dr. A. Becherer's proposal for the 1935 Congress).

In view of this susceptibility of the rules to be misinterpreted because of their misplacements, Arts. 31-35 have been proposed to be transferred to their proper places in Appendix VII of the Rules. A recommendation might be inserted in the code advising botanists to follow horticultural rules for cultivated plants that cannot be placed in any definite taxonomic categories. If these Articles are transferred to Appendix VII, then Art. 14 is not required; besides it is questionable whether the definitions of half-breeds (*mistus*) and hybrids (*hybridus*) will be uniformly accepted by taxonomists, horticulturists and geneticists; for the application of these terms is made dependent on taxonomic opinion regarding the status of the putative parents of the hybrids, e.g. *Vinca rosea*  $\times$  *V. alba* (*hybridus*) = *V. rosea*  $\times$  *V. rosea* var. *alba* (*mistus*). (cf. also Furtado in Gard. Bull. Straits Settl. XI (1939) 10-13 and in Fedde, Repertorium XLIV (1938) 244-255).

### 15. The Rule of Superfluous Names

Sound jurisprudence demands clear distinctions in the rules of validity, priorability and legitimacy. The rule of validity should tell when a name should be admitted as a valid nomenclatural entity, all names having no claim to recognition by botanists being invalid (Art. 19A). The rule of priorability should direct when a given valid name should be included in priority considerations; while the rule of legitimacy should decide whether a certain priorable name is legitimate or illegitimate in the given circumstances. But instead of distinctions, all the offences against these three categories of the rules have been lumped together in Art 60 as if they all mattered directly to the priority rule, thus overlooking the important fact that only the names that are valid and priorable can be included in priority considerations. A further complication arises because in certain cases the procedure has been inverted in Art. 60, so that the rule of priorability is made dependent on the correct application of the rule of priority. Thus the name becomes impriorable merely because it has been instated against the priority rule.

Furthermore in a code where the rules are made to be followed, there is no need to enumerate separately all the offences that may be committed under the provisions already in the code. Such an additional enumeration increases unnecessarily the bulk of the code, and may bring about ambiguity in some of these offences, especially when, as in Art. 60, they are all lumped indiscriminately together. However, it is of great importance to classify the offences according to their four categories referring to validity, priorability, legitimacy and propriety of names (the last mentioned category being concerned with the correct gender, spelling, manner of citation, and authorship). It is desirable to delete Art. 60 altogether, and to provide for the classification of these four categories of offences (cf. Furtado in Gard. Bull. Straits Settl. XI, 1939, pp. 1-4 and Arts. 2B, 19A & B, 53A and 59-69).

However, in most cases, names published in violation of the priority rule cannot be employed as legitimate, not because of the existence of Art. 60, but because the priority rule (Art. 56) prescribes the use of the oldest priorable name or epithet that can be adopted in the required position. Thus, in the example discussed under Art. 60 (1) *Cainito* Adans. (1763) has to be disregarded because *Chrysophyllum* L. (1753) is the oldest usable name in the given circumstances. There are also cases where a new name is not synonymous with the names cited under it. The citation means either that the cited synonym is taken in a particular

misinterpreted sense, or that the new name is taken in a very wide sense. In the latter case, the included synonym is considered taxonomically or ecologically a minor or less primitive group to be separated co-ordinately, whenever the sense of both is severely restricted. Rejection of such new names would cause more problems than it would solve, and may necessitate a lengthy *nomina specifica conservanda*. The best solution in all these cases is to ignore Art. 60 altogether and to treat the names under the rule of typification (*see next Discussion*). This principle would find a strong justification in the procedure followed prior to the 1935 Rules by almost all supporters of the type and priority concepts. Its abandonment now appears to have been voted without foreseeing the evil consequences that would result therefrom. In the accompanying amendments therefore directions for definite typification of such names have been given, Art. 60 has been eliminated and provision for the classification of offences according to their different categories has been included.

## 16. Superfluous Names Under the Rule of Typification.

In order to follow the principle elaborated above, it would be useful to examine here some examples:

Example 1: E. GEDNER (*Ficus*, 1786, pp. 5, 11 & 15), in a dissertation prepared under the direction of THUNBERG, quoted "*Ficus pumila* Linn. Syst. Veg. p. 922" in the synonymy of a new species, *F. erecta* Gedner. On the face of this circumscription, *F. erecta* appears to be a "superfluous" name (Art. 60-1). But from the original specific description as well as from the fact that GEDNER has retained *F. pumila* (bearing the same reference) as a good species, it is obvious that some such word as *partim* was understood after the synonym. This case is clear because GEDNER has treated both *F. pumila* and *F. erecta* in the same pamphlet; had he restricted himself to describing only the new species, Art. 60-1 would have been applied without any further inquiry. Rather than reject *F. erecta* as a "superfluous" name and thereby create complications, the species should be typified on the holotype or lectotype of the new description.

Example 2: *Cerastostylis eriaerioides* Hook. f., Ic. Pl. (1891) 2074 was a "superfluous" name because it was based on *Eria pygmaea* Hk. f., Fl. Brit. Ind. V (1890) 804, a priorable name having an epithet that could have been adopted in the new position. But since *C. pygmaea* (Hook. f.) comb. nov. cannot now be used because of *C. pygmaea* Evard. ex Gagn. in Bull. Soc. Bot. France

LXXIX (1932) 33, *C. eriaerioides* Hk. f. must be employed as the correct (legitimate) name. To reject this last name as "illegitimate" with Hook. f. as its author and then to adopt it again under a different authorship and different date as a non-homonymous name is not a satisfactory procedure (*see* Discussion on Later Homonyms 22).

Example 3: *Wendtia* DC. (1830) was published as a better spelling for *Wendia* Hoffm. (1814). *Wendtia* DC. must not be rejected as having no claim to recognition, on the plea that it was "superfluous" nor *Wendtia* Meyen (1834) be allowed as a non-homonymous legitimate name (*cf.* Furtado in Gard. Bull. Straits Settl. IX, 1937, p. 252). These names must be typified on their respective types. *Wendtia* Meyen (1834) cannot be accepted because it is a later homonym of *Wendtia* DC. (1830) (*see* Discussions 28 and 29).

### 17. The Nomenclatural Types

The first part of the Note under Art. 18 states that "the nomenclatural type is not necessarily the most typical or representative element of a group". Since the word *typical* has no relation whatsoever to the word *type* occurring in the same sentence, and since the word *representative* is nowhere defined in the Rules, the above quoted sentence appears to express a contradiction in terms; and CROIZAT, even after distinguishing between what he called *physical* and *nomenclatural* types, found the statement in the note incomprehensible (Journ. Arnold Arb. XXII. 1941, pp. 133-142). In order to make the meaning clear therefore the following revision of the Note is suggested:

The nomenclatural type does not necessarily represent the element of a group that is genetically the most simple, phylogenetically the most ancient, ecologically the most common, taxonomically the most polymorphous, or biologically the most perfect.

Further, for the purposes of nomenclatural rules, the lowest category to which taxonomists can go is not the individual plant as implied in Arts. 10 and 12, but the *type specimen* as implied in Art. 18. Specimens from the same individual may show different phases of growth. Names given to monstrous specimens may not be priorable (Art. 65); and in certain fungi only specimens from the perfect stage of the individual must be considered as valid types, so that earlier names based on invalid types cannot replace those based on valid ones (Art. 57). It must be further admitted that genera as a rule are based on specimens and in some cases these specimens are not the nomenclatural types of any of the included species. This is particularly

true of the new monotypic genus where the "type species" has to be designated with the epithet of an older species. The statement therefore that the type of a genus is always a species has misled botanists to give contradictory decisions. This statement applies well to the genera in Linn., Sp. Pl. eds. 1 and 2, where each genus has been instated merely by mentioning the species included under it, a procedure contrary to Art. 41, but allowed as a special case under Art. 42 (second paragraph). But in all other cases, the genus has to be associated with its holotype or lectotype specimen. Only when the specimen type of the genus and that of its species are identical, may the type of the genus be indicated by merely mentioning the species. In the accompanying amendment (Art. 51A Note 3) provisions are therefore made for observing this principle.

If these principles were adopted, the amendments proposed by CROIZAT regarding the type in Arts. 18, 30, 51, 52, 61 and Rec. XVIII and XXXV are not needed; and without the acceptance of these principles, the amendments suggested by CROIZAT are not workable in many cases. However, in Rec. VII the word "type" should be replaced by the word "syntype" (*see* Furtado, *Nomenclature of Types in Gard. Bull. Straits Settl. IX, 1937, pp. 285-309*). It is also necessary to delete from the third line in the example of Art. 18 the words "and description" and to substitute "subdividing" for "revising" in Rec. V (*see also Discussion 19-21*). Further since "var. typica" does not indicate a separate ternary group other than the species itself, it would be misleading to say that a species has been established on one of its varieties. As shown in Discussion 4 the simultaneous publication of priorable names for a variety and its species both based on one and the same specimen is a systemic incompatibility under the binary binomial system of names (*see also Discussion 18*).

## 18. References to Misapplications

It is stated in Art. 18 that "the name of a group must be changed if the type of that name is excluded (*see* Art. 66)". Now Art. 66 is to be applied in particular circumstances; its application cannot therefore be generalized in Art. 18 so as to make it applicable in all circumstances. Art. 66 has nothing to do with the nomenclatural type which has been defined as "that element of a group to which the name of the group is permanently attached". (Art. 18); Art. 66 forbids the use of a name for a higher group if that name has been derived from the name of a genus which is not retained in the group.

An erroneous use of the word "type" to mean "the root-name" in the sentence of Art. 18 where the "type" otherwise means "nomenclatural type" has misled many to the conclusion that a new name connoting a new taxonomic group can be validated by referring to a residual description after its type has been excluded from it. But this conclusion overlooks the fact that a taxonomic group ceases to exist when its type is excluded from it (cf. Furtado in Gard. Bull. Straits Settl. IX, 1937, pp. 258-267). The 1935 Congress, by deciding that *Tsuga Mertensiana* Carr. and *T. Mertensiana* Sarg. *non* Carr., were not two homonyms, but one and the same name, *T. Mertensiana* (Bong.) Carr. *emend.* Sarg., with *Pinus Mertensiana* Bong. as the basonym (Art. 54), showed that a misinterpretation does not create a new taxonomic group, nor a new type.

A misinterpretation based on new specimens implicitly includes also the type of the misapplied name. Besides, such a description does not indicate how much of it is based on the old type, and how much on new misidentified specimens. Often the new description is the old description slightly altered in order to cover new data based on re-examination of the old specimens and additional data of what is regarded as a subordinate variation of the same group though noticed only in the new specimens. This new description cannot be dissociated from the old type included implicitly in the new description. Thus *Gonolobus rostratus* (Vahl) R. Br. (1809) *sensu* Schlechter (1899) is not able to validate *G. jamaicensis* Rendle *nom. nov.* in Journ. Bot. LXXIV (1936) 245; for RENDLE, by excluding the type from the description of SCHLECHTER, intended to create a new taxonomic entity. RENDLE should have therefore given a new description and in Latin. If, on the other hand, *G. rostratus* as described by SCHLECHTER were admitted to mean that it is SCHLECHTER's description *minus* the type of *G. rostratus* (Vahl) R. Br., then contrary to the provisions in Arts. 47 and 54, every misinterpretation of a name would create a new homonym, and so *G. rostratus* R. Br. *sensu* Schlechter would be equivalent to *G. rostratus* Schlechter, though SCHLECHTER himself had admitted VAHL's type as the type of the group he re-described.

The only safe guide for the botanist who wishes to make a new taxonomic group out of a misapplication is to re-describe it at the time of publishing its new name. In view of this I propose the deletion of the misleading clause from Art. 18, and have added a special note in Art. 37 so as to deny explicitly any valid status to misapplied descriptions and names.

### 19. Typification of Names in Starting-Point Works

In a previous paper I attempted to show that the names published even without any description but in books adopted as nomenclatural starting points cannot be rejected as invalid (cf. Blumea, Suppl. I, 1937, pp. 123-132). In a subsequent paper I pointed out that often LINNAEUS, in adopting pre-1753 names, did not retain the original sense, and that it is to oblige botanists to typify the names on their 1753-types, and not on their previous ones, that the 1905 legislation fixed 1753 as the earliest starting-point for the species and genera, and invalidated earlier references under the same name (Furtado in Gard. Bull. Straits Settl. X, 1938, pp. 162-172 and Art. 42 (2) and Art. 44 (2) of 1935 Rules). According to these principles, therefore, the name adopted in any starting-point book should be typified on the description given (if any) and the types cited or implied in the book itself, even when the name and its description in this book is taken bodily from an earlier book having different types (cf. also Art. 54 in 1867 Code and De Candolle's Commentary on it).

This procedure is fundamentally opposed to that adopted by KUNTZE (Revisio Genera Pl. 1891-98 and with POST, Lexicon 1904), who typified the names on their history prior to their validation under the Rules. KUNTZE's plea was that nobody should have any right to change the application of a name after its publication, even if this publication were before the starting-point, and, therefore, invalid. But decisions made by the 1905 Congress obviously condemn KUNTZE's procedures of typification, and permit the names to be typified on any syntype used in the starting-point books (Furtado in Gard. Bull. Straits Settl. X, 1938, pp. 173-181). Much of the confusion that exists among mycologists on the interpretation of the Friesian species and genera could be eliminated by following this general principle. The botanist who detects any *mixtum compositum* should have the right to choose any of the specimens as the lectotype on botanical grounds (Furtado in Gard. Bull. Straits Settl. IX, 1937, pp. 244-249 and XI, 1939, p. 18 Art. 22B).

### 20. Typification of Names on the Author's Manuscript Notes.

No typification of names should be made solely on clues left by the authors on herbarium sheets. Such notes or signs are often of a provisional nature, and if they were of paramount importance in typification, they should have been published. A botanist may often name a specimen in a herbarium because it looks aberrant; he may even indicate it as the type of the name and make numerous notes on the sheet. Yet he will often delay the publication of the group

until he has had better specimens for study. In such cases the information found on the herbarium sheet first seen by the author may be misleading. Besides, not all the sheets subsequently studied by the author may be in the same herbarium, and where isotype duplicates are available, subsequent botanists need not apply for the original material, especially in cases where such material is not easily loaned nor allowed to be photographed. There are also cases where the original notes have been placed in the herbarium on wrong sheets during the course of mounting or remounting the same. In view of this, unpublished herbarium data should be used with the greatest caution, and must not be allowed to form the sole or even the principal basis for rejecting a typification made on published information. Much confusion has often been created by overlooking this principle (cf. Furtado in op. cit. X, 1939, pp. 330-335). However if no lectotype has been selected, such data might provide excellent clues for the valid typification of the taxonomic group. It is essential also that the lectotype should not be lightly chosen, and without any necessity (Furtado in op. cit. IX, 1937, pp. 296-299). That by a wrong selection of a type the whole series of subsequent studies may be misdirected is evident from the case of *Rhus filicina* DC. (1825) typified in Art. 51 Note 1 and Note 3 (examples in the accompanying proposals) (see also Discussion 21 below).

## 21. Typification of Names with a Meaning

From time to time one comes across botanical names whose special meaning contributes to make them treacherous typification-quizzes. The elements which botanists have to consider in such cases are two, namely: (1) the root of the name itself which refers to the collector, locality, ecologic conditions, vernacular name, economic uses, or to some such data found on the label or sheet of one specimen; and (2) the validating description based primarily on another specimen. Which out of the two specimens should be chosen as the lectotype?

From the type concept as elaborated in Art. 15, 18 and 59, it is obvious that the nomenclatural entity must be typified on the specimen on which the validating description was based; the particulars derived from wrongly assigned specimens must therefore be ignored (see previous Discussion 20).

Should it be decided that a name must be typified on the type that formed the source of the name and not on the one that formed the chief basis of the description, then such a ruling would be tantamount to giving a permission to

establishing a taxonomic group merely by indicating the specimen and its collector, locality, ecology or vernacular name. It must not be overlooked that often names are taken from imperfect specimens, useless for any precise identification, whereas the descriptions are drawn from better material. Several authors have founded the names of genera and species of orchids on clues found on imperfect syntypes in the herbarium, but have based the validating descriptions on perfect living material. It is obvious that, in such cases, what validated the name is the description based on the type studied. To ignore this and to disregard the type of the validating description in order to follow a line of the least resistance in typification is to torpedo the type basis concept altogether. The principle of typifying a taxonomic group having two "types" of the afore-mentioned categories is in no way analogous to the principle adopted in typifying a new combination whose instantment has been accompanied both by a new description and the citation of the validating basonym. Here the epithet is attached to the type of the description of the basonym and so the author of a new combination is not free to apply it to another type and description. On the other hand, a name created for a new taxonomic group has to be interpreted on the types of the principal part of the description. This interpretation of the taxonomic group has nothing to do with the derivation of the name; for, the purpose of giving a name is not to indicate the characters or the history of the group but to supply a means of referring to it (Art. 15). This contention might seem contrary to the Rec. XV (f) in the Rules; but the fact that a principle has been embodied in a recommendation is a clear proof that it is not obligatory. The purpose of Rec. XV (f) is to discourage names being made from such root-words as might mislead inexperienced inquirers to erroneous conclusions. It is not meant to be applied in typifying names already made.

Thus, in the case of *Carex Oederi* Retz., NEIMES (Journ. Bot. LXXVII, 1939, p. 301) has shown that RETZIUS based his specific description not on Oeder's figure (a syntype cited), but on a specimen identical with *C. pilulifera* L. Later RETZIUS himself recognized the correct identity of the species and made a reduction accordingly. If RETZIUS's specimen were a new species and not identical with *C. pilulifera*, then *C. Oederi* would have been used as the legitimate name for the species. To say that, in such an event "it would have then been logical, not to call the new species *C. Oederi*, but to give a new name, such as *Retzii*" (Airy-Shaw in Kew Bull. 1947, pp. 35-37) is not a logical procedure. To be logical the first botanist to

recognized the *mixtum compositum* should have the liberty to typify the species on any one of the two syntypes on botanical grounds (see Discussion 19). The derivation of the word would not be a good botanical ground for making such a choice. In publishing the variety *Aristida capensis* var. *Dieterleniana* Schweickerdt (Kew Bull. 1939, p. 653) the author indicated (not without reason) *Celiars II* as the type and not *Dieterlen 1205*. In *Ormocarpum Kirkii*, SPRAGUE and MILNE-REDHEAD (Kew Bull. 1934, pp. 42–43) have shown that *Kirk's* specimen was imperfect and that the description was primarily based on *Hildebrandt 1935*. In *Poa amboinica* L., Mant. Alt. (1771) 557, though the specific epithet was derived from a Rumphian name, the validating description was based on an Indian specimen (both the Rumphian plate and the Rumphian description being pre-1753 should not have any status except that of a herbarium specimen and its manuscript description in the herbarium, none of which are admissible for effecting the validation of a name by reference). But apart from this, RETZIUS (Obs. Bot. iv, 1786, p. 20) recognized the *mixtum compositum* in the Linnean species and excluded from it the Rumphian syntype as the discordant element. This typification was generally accepted until challenged by MERRILL (Interp. Rumph. Herb. Amb., 1917, p. 88) on what are in my opinion erroneous assumptions. This challenge was upheld by FISCHER (Kew Bull. 1934, pp. 398–400) on the derivation of the trivial epithet of the specific name, and recently by AIRY-SHAW (op. cit. 1947, p. 36), because "Linnaeus adopted, from Rumphius, the geographical epithet *amboinica*". I contend that in the interest of stability and finality of names the typification made by RETZIUS should be adopted. (For criticism of Merrill's and Fischer's views see Furtado in Gard. Bull. Straits Settl. IX, 1937, pp. 297–298).

Another example worth considering is the typification of *Eranthemum* L. (1753) by SPRAGUE in Kew Bull. (1926) 98. Here SPRAGUE confuses the issue by saying that *E. capense* L. (1753), the only species under the genus, "was based on a plant collected in Ceylon by Hermann, and described by Linné under the name *Eranthemum* in Fl. Zeylan. 6 n.15 (1747) and Amoen. Acad. i. 384. In Sp. Pl. 8 Linné unfortunately confused this with a Cape plant. . . ." This statement of SPRAGUE suggests that the binomial *E. capense* was originally given to a Ceylon plant but that later LINNAEUS was confused and adopted the name also for a Cape plant. Actually *E. capense* was first instated in 1753 and it then included elements from two sources as far as the citation of references were concerned: Ceylon and the

Cape; but under the habitat LINNAEUS mentioned only "Aethiopia" which included the Cape but not Ceylon. In *Species Plantarum* (1753), which is the starting-point book for the nomenclature of the genus and its species, LINNAEUS need not employ *Eranthemum* in its pre-1753 sense; under the Rules he is free (retrospectively) to give the name in 1753 any sense he liked. If he applied it to a Cape plant, he cannot be said to have misapplied the name. Further since in *Sp. Pl.* (1753) the genera are validated merely by mention of the species (an exception to the usual procedure Art. 41 and Art. 42), *Eranthemum*, when typified, should include *E. capense*. However, those who follow RADLKOFER (*Sitz. Kaiser. Bayr. Acad.* XIII, 1883, p. 285 et annot.), KUNTZE (1890-98 and 1904) and SPRAGUE, and accept references back under the same name (invalidated under Arts. 42 (2) and 44 (2)), take *Eranthemum* as having been validated by reference to a previous description under the same name though this previous description and name had a different meaning. On this basis they typify the genus *Eranthemum* on the Ceylon plant mentioned by SPRAGUE above, but generally transfer the binomial *E. capense* sensu typico (the African plant) to another genus. In other words these botanists remove from *Eranthemum* L. (1753) the very binomial or species (*E. capense*) that validated the genus and is the type of the genus, a procedure quite contrary to Arts. 51-52 of the Rules.

The case of *Eranthemum* appears to be as follows: Before 1753, LINNAEUS based the genus on HERMANN's specimen from Ceylon; but in 1753 he found a specimen from the Cape which agreed well with his generic conception of *Eranthemum*. This specimen, which was also described by HERMANN in the reference quoted by LINNAEUS under *E. capense*, was from a plant grown from the seeds sent from the Cape by OLDENLAND. Could it not be that *Eranthemum* was wrongly attributed in 1747 to Ceylon? HERMANN had collected both in Ceylon and in the Cape, and many of his specimens were mixed in mounting. LINNAEUS, however, had not at the time HERMANN's Ceylon specimen with him to clear these doubts (fide R. BROWN, *Prodr. Fl. Nov. Holl.*, 1810, p. 332). But he knew that the Cape plant was a new species and required a binomial under his new scheme. LINNAEUS therefore gave the Cape specimen the binomial *E. capense* and therefore mentioned only "Aethiopia" under the habitat, and excluded Ceylon though he gave a reference to the Ceylon specimen also. It is this binomial that validated the genus.

There was no mistake about the specimen being a new species or from the Cape. Reference to a previous description under the same name does not validate the genus (Art. 42-2), but serves to show its previous history. The mistake attributed to LINNAEUS is attributable only when references to previously published descriptions under the same name are admitted against Art. 42 (2), and LINNAEUS is deprived of the right to give in 1753 any sense he liked to a previous name. The genus *Eranthemum* should therefore be typified on *E. capense*, as this binomial validated the generic name; and this species not only included OLDENLAND's specimen from the Cape but was stated to be from Africa only.

It may be noted that ALSTON in Handb. Fl. Ceylon VI (1931) 226 and 228, uses *Daedacalanthus* R. Anders. and *D. jastigiatus* (Lamk.) Alston for *Eranthemum* L. *sensu* Radlkofer (1883) and *E. montanum* Roxb. respectively, and Pegafetta Adans. and *P. malabaricum* (Clarke) Alston for what has been called *Pseuderanthemum* Radlk. and *Ps. malabaricum* (Clarke) Fischer, thus retaining *Eranthemum* L. and *E. capense* L. for the Cape plant typified on Oldenland's specimen. A good deal of confusion made in these genera can be best removed by following ALSTON's typification of *Eranthemum*, especially when *Pseuderanthemum* has also been misused. (In a recent paper BREMEKAMP and NANNENGA-BREMEKAMP have typified both *Eranthemum* and *E. capense* on the Ceylon plant, but have not discussed the previous typifications (Nederl. Akad. Wet. Verh. (Sect 2) XLV no. 1 (1948) 33).

## 22. Later Homonyms

Types have been unnecessarily emphasised in the definition of a later homonym, so that it seems possible to reject an earlier valid name as "illegitimate" and to accept an identical later combination with a different authorship or date as legitimate. Thus, for instance, *Pseudotsuga taxifolia* (Lamb.) Britton (1889), although admitted as valid with a force to render a later name with a different type "illegitimate" (impriorable), has itself been rejected as "illegitimate" and considered without any force to render *Ps. taxifolia* (Lamb. ex Poir) Rehder (1938) "illegitimate", because the latter combination has the same type as the former; accordingly the latter combination has been declared as the legitimate (correct) name for the Douglas Fir (Sprague and Green in Kew Bull., 1938, pp. 79-80; for further similar examples see Furtado in Fedde, Repertorium XLIV, 1938, pp. 256-264).

But the Rules provide that an alteration in diagnosis and in circumscription, however considerable, but "without the exclusion of the type does not warrant the citation of an author other than the one who first published its name", though the authorship of considerable emendations may be indicated (Art. 17). In the aforementioned case, however, SPRAGUE and GREEN have given to the authorship of names an importance unwarranted under Art. 47, so that, under their view, the authorship would become an important part of the botanical name. They have overlooked the fact that the correct citation of authorship is not a problem that concerns validity, priorability or legitimacy of a name; it affects only its propriety. If the view of SPRAGUE and GREEN were valid, then the rejection of homonyms established by different authors would become meaningless.

This opinion of SPRAGUE and GREEN on homonyms does not accord with the spirit of the Commentary made by the British botanists responsible for the present wording of the rule of homonyms. Declaring that it is a sheer waste of time to oblige botanists to undertake critical research to find out whether or not a prior homonym is legitimate in a given position (p. 5), the Commentary states that "this Article prohibits the duplication of names which have been published with a description (or reference to a former description), even if they are *illegitimate*. It will stabilize nomenclature, especially in the numerous cases where there is doubt or dispute whether a prior homonym is illegitimate or not". (Brit. Proposals, 1929, p. 43). Professor REHDER states in the Preliminary Opinions, Amsterdam, 1935, Art. 47 bis, p. 14, that the meaning of a name "should be clear even without author citation, since the author is often omitted, particularly in applied botany and popular publications. We have to consider also the use of botanical names outside of strictly taxonomic work."

From the foregoing I conclude that the opinion held by SPRAGUE and GREEN on the legitimacy of orthographically similar names when an earlier one is rejected, cannot be maintained. Due amendments are therefore proposed to make the rule of homonyms more precise (*see* Arts. 61A-B and Art. 52B-D, and also discussion on superfluous names in 14-15).

However Art. 47 could be made more explicit as to the manner of citing the correct name for the Douglas Fir. From Art. 69 it looks as if *Ps. taxifolia* Britton (= *Ps. taxifolia* (Lamb.) Britton), and not *Ps. taxifolia* (Lamb. ex Poir.) Britton *emend.* Rehder or *Ps. taxifolia* (Poir.) Rehder, is the correct way of expressing the authority of the first valid and priorable instatement of the name.

### 23. Specific Epithets under an Impriorable Generic Name

Later homonyms, unless they be conserved generic names, are impriorable, that is, they are valid but cannot be included in priority considerations. This should have deprived specific epithets instated under an impriorable genus of the right of priority even outside the genus. Thus, since *Rademachia* Thunb. (1776) is a later homonym, the combination *R. integra* Thunb. (1776) can never be legitimately used, and so when THUNBERG established a new genus *Sitodium* (1779), the combination *S. macrocarpon* Thunb. (1779) should have been the legitimate name for the species. This procedure can be defended also under the strict wording of the present Rules which prescribe that only "legitimate" combinations (that is, those satisfying all the rules—Arts. 2 and 45) should be used in priority considerations. But as this procedure would not contribute to economy in specific epithets and would also lead to ignoring important contributions made to the systematy of the genera bearing names which are later homonyms, and since later homonyms themselves are made usually in ignorance of the existence of the previous homonyms, the modern tendency has been to allow priority to the specific epithets instated under an impriorable genus. Further it must be borne in mind that all specific epithets instated under an impriorable genus form an obstacle to the formation of exactly similar combinations under an earlier priorable generic homonym. These reasons therefore justify the custom of allowing priority to the specific epithets instated under an impriorable generic name. An appropriate amendment has been proposed in the Rules to clarify this problem.

However, an admission of priority to such epithets should not be mistaken as an opening for admitting as priorable, the specific epithets instated under no genus, or under an invalid genus, or under a generic name which was intended to be but was not actually instated. As the epithets instated under such circumstances are invalid, the question of their priorability does not arise. The invalidity of specific epithets under an invalid or no generic name might seem so axiomatic under the binomial binary system of nomenclature for species (cf. Linnaeus's *Aphorisms* 257 and 286 and comments on them in *Critica Botanica*), that one might well question the need of emphasising the fact here; but Discussion 24 will show that there are nomenclaturists who question the validity of the axiom, and that there is a definite attempt to amend the Rules so as to admit such specific epithets as valid. The reader should therefore bear in mind the status of specific epithets instated under a

valid but impriorable generic name, so that, in the following discussion, the distinction between it and the status of the epithets attached to no generic name or to a generic name that has no status under the rules may be clearly recognized.

#### 24. "Binary" Names under an Invalid Genus

Art. 67 states the conditions under which a generic name must not be admitted even when otherwise it seems satisfactory under Arts. 25, 37 and 42. But since WALTER's "genus" *Anonymos* satisfies none of these Articles, there should not be any doubt of its being invalid, i.e. status-less under the Rules. In fact the legislators have singled out this term as an example of a word that cannot be considered as a valid generic name under Art. 67 (1); no further doubt should therefore arise about its invalidity. And it is obvious that, from the very definition of the binary name, the specific epithets instated under *Anonymos* should be equally invalid (cf. Linnean Aphorisms 257 and 286, and Art. 27 of the 1935 Rules). Yet SPRAGUE proposes that, in the following amendment, the Congress should state in the form of a rule that the specific epithets preceded by the word *Anonymos* are invalid even though the proposed rule applies to that particular word only:

"Binary combinations of a specific epithet with the word *Anonymos* are illegitimate, since the word *Anonymos* is not a generic name (Art. 67(1)). Such combinations are not taken in consideration for purposes of priority of the epithet concerned.

"Example: The binary combination, *Anonymos aquatica* Walt. Fl. Carol. 230 (1788) is illegitimate. The valid name for the species concerned is *Planera aquatica* J. F. Gmel. (1791), and the date of the epithet *aquatica*, for purposes of priority, is 1791. The species must not be cited as *Planera aquatica* (Walt.) J. F. Gmel. If, however, it is desired to indicate that the epithet originated with Walter, the name may be cited as *Planera aquatica* [(Walt.)] J. F. Gmel." (Kew Bull. 1939, p. 318, sub Art. 27).

The Rules empower the Congress to suspend, in certain cases, the application of the rule of priority; but even then it is better for the Congress not to exercise this power if the effects of the proposal can be secured by applying the existing rules (cf. Furtado in Gard. Bull. Straits Settl. IX, 1937, p. 253). But when the Congress is asked to give a special decision on a particular case and embody that decision in the form of a rule applicable to that case only, it is time for the Congress to call a halt and consider whether such a procedure might not create an undesirable precedent and affect seriously the normal practice. Moreover, special decisions, when given unnecessarily, and/or embodied in the form of a special rule applicable to that case only, often

mislead taxonomists into thinking that the results secured by a special decision or rule were otherwise not attainable. This sows a seed for the future misinterpretation of the rule applicable to the case. If the existing rule were invoked and the deductions were accordingly made, the decision would have reinforced the rule and prevented its future misinterpretation, a procedure, I believe, followed with great effect by zoologists. When advisable, the case could be cited as an additional example illustrating the application of the particular rule. Hence there are grave objections to adopting SPRAGUE's proposal. I note also that the editors (Camp, Rickett and Weatherby) of the 1947 special edition of the International Rules of Botanical Nomenclature object to cluttering the main body of the Rules "with decisions on individual cases" which "might very profitably be relegated" to appendices or to a series of opinions.

But apart from this novel way of trying to outlaw the alleged "binary" combinations (for the Congress has disapproved the principle for rejecting properly instated specific names) there are also serious objections to the wording of the proposal itself; for the invocation of Art. 67 (1) means that, since WALTER *did not intend* to adopt Anonymos as a generic name, the specific epithets cannot be taken to have been published validly. Thus put, the reason for rejecting WALTER's specific epithets under Anonymos misdirects the whole issue; for one conclusion from this premis would be that, had WALTER *intended* Anonymos to be a generic name, then 44 specific epithets published by WALTER under Anonymos would have been valid, despite the fact that Anonymos was never described as a taxonomic group to satisfy Arts. 37 and 42 or 43. So the word "binary" in Art. 27 would be synonymous with biverbal, in which sense SPRAGUE has used the word in the proposal. This would mean, therefore, that specific epithets could be validly instated under a status-less (invalid) generic name, a conclusion I have nowhere found seriously maintained except by a few botanists who use the word "binary" very loosely to mean biverbal (cf: Sprague and Riley in Journ. Bot. LXII, 1924, p. 7 and Sprague and Hubbard in Kew Bull. 1933, p. 15 and 1936, p. 319).

The principle involved in the above-mentioned proposal goes against the essence of binary binomial nomenclature itself. Its admission would defeat the very purpose of prescribing binary binomial nomenclature to species. In arguing the fallacy of this theory and the contradictions involved, I had also discussed the invalidity of the specific epithets proposed by WALTER under Anonymos, not only

under Art. 27, but also under the rule of *nomina vel epitheta provisoria*, for all these epithets were published in the hope that future botanists would put them under their proper genera, WALTER himself not having assigned them to any known genus. It is true that some botanists attributed the epithets to WALTER, but it has already been shown that such attributions are wrong (retrospectively) under the present Rules and that these epithets stand on the same footing as the (retrospectively) invalid names taken up from WALLICH's catalogue by subsequent botanists and attributed to WALLICH. WALTER's specific epithets were shown to have been validly instated by GMELIN (1791) and others, who therefore become the real authors of the epithets under the Rules. In such matters custom cannot be invoked in order to nullify a clear law (Furtado in Fedde, Repertorium XLIV, 1938, pp. 256-264).

By accepting the definitions of the terms binomial, binary and biverbal indicated in Discussion 2 of this paper, it becomes clear that a specific name which indicates only one description (unless that description be of the *descriptio generico-specifica* class) can be neither a binary nor a binomial, though it may be a biverbal. The specific epithets "instated" under Anonymos by WALTER, like such biverbals as *Villebrunnea integrifolia* Gaud. and *V. crenulata* Gaud. are, therefore, neither binary nor binomial, for in each case the combination indicates only one description. Hence these combinations deserve no recognition from botanists, though *Villebrunnea* was *intended* to be a generic name but never associated with any generic description (cf. Furtado in Bull. Jard. Bot. Buitenz. XVI, 1939, pp. 116-119). In fact *Villebrunnea* does not come under Art. 67 at all; for Art. 67 deals with names which are inadmissible under the Rules even when they are properly published and are accompanied by generic descriptions. It does not deal with cases where admissible generic names are not accompanied by generic descriptions, for the obvious reason that names without descriptions are invalid (Arts. 37 and 42). However it has to be admitted that the examples given in Art. 67 are not carefully chosen to illustrate the various points dealt with in the rule, and Anonymos is one of the ill-chosen examples.

The use of the word "binary", and the way of invoking Art. 67 (1) in the amendment proposed by SPRAGUE are therefore misleading. The epithets concerned are invalid (without any status) under the existing rules (*see also* Furtado in Philipp. Journ. Sc. LXIX, 1939, pp. 467-469). I contend therefore that the proposed amendment should not be approved.

As to the manner of citing the authority of an invalid name, when validated by another author, the subject is to be dealt with in Art. 48. But I doubt the advisability of quoting the author of an invalid name in a double bracket.

## 25. The Fallacies of Implicit References

In Kew Bull. (1937) 475-476, under the title of "Epipogum or Epipogium" SPRAGUE and GREEN have defended a procedure based on two fallacies, namely, (a) the incidental mentioning of invalid or provisional names constitutes a definite acceptance of the names, a procedure condemned by Art. 37; but, since this assumption does not carry one very far, for the names would still remain without a valid description, and, therefore, invalid, the second assumption is made, that is, (b) the name incidentally mentioned is validated by an implicit reference to a description published previously *under the same name*.

In disputing this theory of implicit reference, I submitted that, in order to decide whether or not the author wished to adopt an older name definitely, the easiest way was to apply the provision in Art. 42 (2), which clause, though ignored by the two authors, invalidates, like Art. 44 (2), references to previous descriptions *under the same name*. From 1905 this provision forms an important part of the Rules, being then introduced to proscribe principally the procedure defended by KUNTZE who, by admitting reference back under the same name to pre-1753 literature, had effected over 30,000 name changes (cf. Furtado in Gard. Bull. Straits Settl. X, 1938, pp. 162-72). Nevertheless, SPRAGUE has now made the proposal to omit the phrase *under another name* from both Arts. 42 (2) and 44 (2). As an approval of this proposal would cause many name-changes, and even remove the definiteness of many other names, a discussion on Art. 44 (2) may not be out of place here (the problems concerning Art. 42 (2) having been already dealt with in my paper referred to above). However it may be noted here that, when SPRAGUE states that many Linnean generic names have been validated by reference to pre-Linnean descriptions (Kew Bull. 1939, p. 323, sub Art. 42), he overlooks the fact that, under Art. 20, if any descriptions are to be associated with the Linnean genera of 1753 and 1762-63, they are the *first subsequent* descriptions in LINNAEUS's *Genera Plantarum* ed. 5 (1754) and ed. 6 (1764). Even if the phrase were omitted, the contention of SPRAGUE would, therefore, be erroneous as applied to the Linnean generic names.

In proposing to omit the phrase *under another name* from Art. 44 (2), SPRAGUE states that "this omission is required to provide for the case of a pre-Linnean binary specific name validly published by a post-Linnean author with reference to the pre-Linnean description." (Kew Bull. 1939, p. 323). This is a very misleading statement. The binary binomial system of nomenclature for species was consistently employed for the first time in 1753. In the case of biverbal specific names of pre-1753 authors, there are many doubts whether the names are merely binary or biverbal, or truly binary biverbal binomials. Sometimes they are biverbal generic names, and therefore unitary; in some other cases they are biverbal and binary but not binomial; in many cases the names are biverbal binomial for forms and varieties, and so not binary; or when binary and binomial, the genus is based on characters of habit and uses, not on floral characters. This difficulty is met with also in the case of those post-1753 books in which the Linnean binomial system was not consistently adopted. To obviate this difficulty the Rules have interdicted all the specific names in such books, even those post-1753 names that seem to be clearly binary, biverbal binomial specific names (Art. 68 (4); also Furtado in Bull. Jard. Bot. Buitenz. XVI 1939, pp. 116-119). Judging from the loose sense in which the term "binary" has been employed, the tendency to admit such names would still be great if the clause *under another name* were omitted. Furthermore, LINNAEUS, Spec. Pl. (1753) and (1762-63) are taken as a sort of check-list wherein are registered all the species till then known to science, and wherein characters are shown in order to be able to distinguish between them. Should a pre-1753 species having a binary, biverbal binomial name be found not to have been taken up in the many editions of *Species Plantarum* and in other descriptive check-lists (e.g. Lamarck's *Encyclopédie*, Persoon's *Synopsis Plantarum*, and Don's *General System of Botany and Gardening*), it would be better now to deny validity to such names even though the names were *registered* or *casually mentioned*, but *not described*, in some lists, catalogues, theses, itineraries or discussions; many name-changes and complications would result by allowing validity to these names (cf. Furtado, 1938 cited above).

Thus, for instance, many pre-1821 names of *Fungi Caeteri* recorded in STEUDEL's *Nomenclator* (Cryptogamia) (1824), would have to be revived if the phrase *under another name* were omitted from Art. 44 (2). The many involved arguments and assumptions made for getting *Poinciana spinosa* admitted as valid (Sprague in Kew Bull.

1931, pp. 91-96) could be easily disposed of by referring the whole question to Art. 44 (2) which SPRAGUE has ignored and which he now seeks to eliminate from the Rules. In all such cases the clauses Arts. 42 (2) and 44 (2) are so to say labour-saving devices for botanists who might have otherwise to consider lengthy arguments before deciding the validity or invalidity of names. By way of illustration I shall discuss at some length the case of *Petroselinum crispum*:

In the Kew Hand List of Herbaceous Plants ed. 3 (1925) 122, the name *P. crispum* Nym. is listed without any description. No one is bound to take any notice of it, because it has not been published before as a valid name, nor is there given under it any definite reference to a previously valid description. But AIRY-SHAW discovered that the name was published in 1879 as a synonym of *P. sativum* Hoffm. and that it was apparently intended to be an isonym of *Apium crispum* Mill. This does not carry one any further, for combinations published in the synonymy are inadmissible (Art. 40), a fact also admitted by AIRY-SHAW though he allowed validity to *P. crispum* Nym. in the following manner:

But the combination has been taken up in the Kew Hand List of Herbaceous Plants ed. 3, 122 (1925), and attributed to Nyman; and it appears that it must be regarded as validly published in that place (cf. Sprague and Green on implicit citation in the case of the generic name *Epipogium*, in Kew Bull. 1937, 475) (Kew Bull. 1938, pp. 256-258).

Later AIRY-SHAW's attention was drawn to the fact that *P. crispum* (Mill.) Nym. was a binomial combination published for a variety under *P. sativum* Hoffm.; and AIRY-SHAW admits that "varietal binomials" are inadmissible under the present nomenclatural system (Art. 28). But under the theory of implicit reference he finds the following way out of this difficulty:

The first valid use of the combination *Petroselinum crispum* (i.e. for a species) is apparently in the Kew Hand List of Herbaceous Plants 122 (1925), and the attribution to Nyman may be taken as validating reference to Nyman's well-known work, where the author of the name-bringing synonym, *Apium crispum* Mill., is cited in brackets. There is clearly no doubt as to the plant intended either by Nyman or by Miller, nor as to the works of those authors intended by the Kew Hand List and by Nyman respectively (Kew Bull. 1939, p. 168).

It may be remarked here that the question of validity or invalidity of a name is not decided by doubts, or the absence of doubts, about the plant intended; otherwise almost all the names in WALLICH's Catalogue would have been valid, for they were accompanied by numbered sets of plants distributed to many botanical institutions. The

alleged obviousness of the work intended by the compilers of the Kew Hand List is not as easy to understand as AIRY-SHAW imagines, for compilers of such Hand-lists do not usually consult original works, but go by herbarium determinations. Often invalid combinations get unwittingly into such Lists. It is more probable that the compilers had never intended to publish a new name, nor to refer to any work, but had merely adopted *P. crispum* Nym. because of the authority of the botanist who had determined their specimens in the herbarium. What the determining authority intended by the binomial is not easy to decide; the binomial might have stood for the variety as named by NYMAN. If such listings are admitted as valid publications of names, then one could also argue that: all pre-starting point names; the names published in works wherein the binomial system has not been consistently employed (Art. 68-4); provisional names; and invalid manuscript names cited in the synonymy, become valid when they are registered in subsequent indexes or nomenclators. Further the mere registration of varietal binomials as if they were specific names would also constitute the valid publication of the binomials as specific names. Even a casual mention of such an invalid name and its author by a careless worker would oblige botanists to admit it as valid and investigate as to what it originally meant, where it was published, the Rules making no distinction between well-known and less known works. This would mean that botanists should possess a list of all the invalid names published before and after the starting points, despite the fact that such names have no status under the Rules. Perhaps the compilers of such lists would then be considered as the real validating authors of the invalid names, since the mere registration has been claimed to give validity to previously invalid names.

From the foregoing it is evident that numerous complications will arise by omitting the phrase "*under another name*" from Art. 42 (2) and 44 (2). This phrase was intentionally inserted in the Articles of the 1905 Rules. If the phrase were retained in Art. 42 (2), many of the proposals to conserve generic names already in use would be unnecessary. Thus the proposal to conserve *Hippeastrum* Herbert (1821) versus *Leopoldia* Herbert (1821) made by SEALY to the 1940 Congress (Kew Bull. 1939, pp. 49-68 and 328) becomes meaningless, for what is already valid and legitimate does not require to be conserved versus a name which, under the existing Rules, has no status and no claim to recognition by botanists (invalid).

## 26. Alternative Names and the Will of the Congress

Discussing the simultaneous publication of *Cymbopogon Bequaertii* De Willd. (1919) and *Andropogon Bequaertii* De Willd., CROIZAT (Journ. Arnold Arb. XXII, 1941, pp. 133-142) states as follows:

De Willdeman believed either that these two names were synonymous in the accepted sense, or that they were not. If he did believe that the names were synonymous, he erred in publishing two names where one was sufficient, the other being superfluous (Art. 16, Art. 60(1)), or illegitimate (Art. 40); if he did not believe, he clearly acted to design a new combination in anticipation of the eventual acceptance of the group, which is a patent violation of Art. 37<sup>ter</sup>, and creates a *nomen provisoriū* (p. 137).

The first part of this argument is faulty, because the two names, being in a different position, cannot be "superfluous" under Arts. 16 and 60 (1). As to the second part, Art. 40 does not apply because *Andropogon Bequaertii* was not "merely cited as a synonym"; it was published as an alternative name to *Cymbopogon Bequaertii*, in order first to indicate that there are two current views about the major taxonomic group, both accepted as taxonomically valid, and then to prevent name-changes being made by others which could be done by the author himself. In discussing this principle in some detail, I had mentioned the complications made by persons who were after easy honours (Gard. Bull. Straits Settl. IX, 1937, pp. 239-240). But I have also come across some examples where botanists, in order to avoid criticisms of the type levelled by CROIZAT, have published the names in one periodical, and the alternative names in another, making it thereby difficult for workers on the groups to collect the necessary references. DE WILLDEMAN could have published either of the two names, and botanists would have accepted the name as valid; and CROIZAT himself would not have any objection to accepting the second name had DE WILLDEMAN published it after the first. CROIZAT's objection is because the two names have been published simultaneously and have saved workers the trouble of looking up two different periodicals for the information that could have been obtained in one.

As to the third part of the argument offered by CROIZAT, that alternative names are provisional, to be outlawed under Art. 37 <sup>ter</sup>, it must be recalled that this point received a good deal of consideration from the Congress at Amsterdam. The President (Dr. E. D. MERRILL) pointed out that the provisional names were against the spirit of the Rules, but that alternative names were not provisional names. From the Proceedings it is

evident that the Congress was of the opinion that, if alternative names were placed on the same footing as provisional names, then none of the alternative names could be accepted as validly published. Thus, in the case discussed both *Andropogon Bequaertii* and *Cymbopogon Bequaertii* would have to be rejected. In view of this and also in view of the complication that would arise as to the authorship, Prof. W. ROBYNS "suggested that, as a matter of practical convenience, such alternative names should be treated as valid", and later amended the proposal by eliminating the word "*seu eventuale*" which, according to the discussion recorded in the Proceedings, referred to alternative names. The proposal thus amended was adopted by the Congress (Proceed. I, 1936, pp. 364-366).

There was no other decision to validate alternative names; but the fact that a proposal to reject both provisional and alternative names was amended with the express object of excluding alternative names from the effects of the proposed rule is a sufficient proof that the Congress regarded alternative names as valid. This conclusion is further strengthened by the different summaries of the decisions taken at the Congress, published in Chron. Bot. II (1936) 38, Journ. Bot. LXXIV (1936) 75 and in Kew Bull. (1936) 186. I have not seen any correction issued to these announcements or to the Proceedings.

It is true that the wording of Art. 37 *ter* is not happy. That the definitions of provisional and alternative names require further clarification so as to prevent conflicting interpretations of the rule was pointed out in my paper quoted by CROIZAT (Furtado in Gard. Bull. Straits Settl. IX, 1937, pp. 230-232 and 239-240). And this faulty wording of Art. 37 *ter* is now the sole basis of CROIZAT's not interpreting the Article on the evidence made available in the discussion that preceded the approval of the rule in the present wording. Hence CROIZAT concludes that the summary given by SPRAGUE of the Congress decisions is erroneous as far as alternative names are concerned, and therefore maintains that Art. 37 *ter*, as approved by "sovereign will of the Congress" invalidates precisely those names to safeguard which the original proposal was amended.

Previous practice of quoting alternative names was very conflicting, a fact also made obvious during the discussion of Art. 37 *ter* at the Congress. Hence the way in which an alternative name has been registered in Index Kewensis cannot be invoked as illustrating an "established custom" under Art. 5. Were a name invalid (without any status under the Rules), the editors of Index Kewensis should not

have registered it at all. Besides, alternative names have not been uniformly registered in Index Kewensis, e.g. *Syzygium paniculatum* Gaertn. and *Eugenia paniculata* Banks ex Gaertn. (1788), *Claytonia Washingtonia* Suksdorf vel *Montia Washingtonia* Suksdorf (1898) and *Lithocarpus* vel *Pasania Rodgeriana* A. Camus (1931). Further if the previously established custom did not approve of these alternative names, then botanists like DE WILLDEMAN could be said to be the breakers of the custom; but the opinion that "any subsequent author who took up the name *Andropogon Bequaertii* would certainly attribute it to DE WILLDEMAN" (an opinion voiced at the Congress both by ROBYNS of Bruxelles and HANDEL-MAZZETTI of Vienna), shows that the previous "established custom" was not what CROIZAT has it to be.

In view of this the botanical public is justified in considering that the Congress has not only accepted alternative names "as a matter of practical convenience", but also condemned expressly the provisional names. Our endeavour, therefore, should be to find a more appropriate terminology for framing the rule in such a way that the "sovereign will of the Congress" shall be unequivocal.

BAILEY (Gent. Herb. II, 1932, pp. 430-433), who upholds the validity of alternative names and quotes many instances, pleads that the Congress should be more precise in defining what a synonym is, so as to prevent confusion between alternative names and synonyms. He cites an instance of an extreme form of multiple nomenclature which, I believe, is rare: *Sedum-Cotyledum-Echeveria-Diodostemon clavifolia* Alwin Berger in Gartenflora LIII, p. 205. It is possible that many alternative names published in the last two centuries have been overlooked, and if their resuscitation now would cause confusion and if there is no way of distinguishing between synonyms and alternative names published in early literature, it would be advisable to consider all long overlooked or ignored alternative names published before 1905 as invalid, and to oblige authors in future to indicate in a definite way whether a certain name is alternative or a synonym (cf. Linnean alternative combinations published under *Melilotus* sub *Trifolium* which have been long ignored).

## 27. Responsibilities of Publishers

The 1930 Congress decided that the validity of a paper reserved for private circulation should not be admitted unless distributed to the institutions to be specified under the Rules; and I tried to show that, unless this specification included certain institutions interested in the work and

unless the distribution were made through a Committee, grave complications would certainly arise (Chron. Bot. III, 1937, pp. 337-339, and in Gard. Bull. Straits Settl. IX, 1937, pp. 273-279). In the latter paper a scheme was worked out so as to secure a priority in distribution for the interested institutions; for I believe validity should not be allowed to a paper, say on the Indo-Malaysian flora, if the distribution to all the Indo-Malaysian institutions is refused or ignored by the idiosyncratic author of the work meant only for private distribution. A distribution to institutions not interested in the work serves no useful purpose; these institutions may even destroy the books which are useless to them. If such a Committee had regional representatives in different parts of the world, the principle would have worked even during the last great war. The regional representative could have undertaken to reserve copies for other institutions to which copies could not be sent owing to war.

However there is now a move to abandon the specification of the institutions required in Art. 36. If the list is to be abandoned, the responsibilities of publishers and/or of authors must be clearly stated; for, owing to the high cost of printing and to the paucity of funds, there is a great danger of systematic papers being published in periodicals least likely to come to the attention of the interested public (cf. examples in Gard. Bull. Straits Settl. IX, 1935, p. 113 and XI, 1939, p. 21 sub Art. 36).

There is also the question of separates. These offer the author an effective means of establishing an exchange with his colleagues. Many publishers, in order to secure first class contributions to their periodicals, are therefore obliged to supply to the author gratis a certain number of separates of the paper. But satisfying the demands of the individual contributors and sending a few complimentary copies for reviews or to some institutions are not synonymous with meeting the nomenclatural requirements for rendering the contributions effective (valid). The demand by authors for separates is for a subsidiary distribution, that is, a distribution having nothing to do with valid publication of the papers. Were publishers of the periodical to make the authors individually responsible for the measures necessary to render the contributions valid, then authors themselves would individually be the publishers of their own contributions (assuming the authors take the measures in question), and the periodical would be merely a review in which the papers are published at second hand (and often with fictitious dates, because the editors of the periodicals would not know when the authors "published" their separates).

Under such circumstances, in giving references to a new nomenclatural entity, the title and the page of the pamphlet, and not the title and the page of the periodical wherein the contribution was subsequently reprinted or incorporated, would have to be cited.

Further, without advertisements, there would be great difficulties not only in subscribing to the papers, but in preventing ineffective (invalid) papers from being passed as effective and at wrong dates. In the case of large books, the publishers are interested in the disposal of the books, at least in order to recoup the initial outlay in printing; so they feel the need of issuing advertisements in due time. But in the case of separates the author does not incur any expenses, nor is he interested in the sale of the separates. In fact any attempts to advertise the sale of a few separates received gratis may involve the author or his agents in financial difficulties. Notwithstanding this aspect of the problem, it has been recently contended that, when advance prints are supplied to the author, the publishers are justified not only in calling these prints "advance separates" of the periodical, but also in reckoning effectiveness from the date on which the prints were supplied to the author.

It is obvious therefore that publishers must be made to realise that to publish a botanical contribution does not mean to print and/or distribute it to special persons or institutions only; but it means that the publication must be made available *in due time* to the interested botanical public. It is evident that no objections are raised for publishing a large work in small parts or fascicles, provided these are made available to subscribers in due time; but publishers cannot transfer their responsibilities of securing validity to the paper to the author by supplying him a few copies of his paper in advance, nor is this duty fulfilled if, in addition to supplying the copies to the author, six copies are sent to be utilised in herbaria or to be reviewed in periodicals. Since at least one institution has offered this as a plea for not sending its periodicals in due time to the subscribers (by purchase or exchange) (Hochreutiner in Candollea VII, 1938, p. 517), it seems necessary to legislate on this point so as to prevent such procedures in future. Necessary amendments have therefore been proposed to deny validity to papers for which no steps have been taken to insure their distribution in due time to the interested public.

## 28. Orthography of Names

In Gard. Bull. Straits Settl. XI, 1939, pp. 4-7, I suggested that the subject of orthography of names be referred to a special committee, so that the question of such

cognate subjects as that of homonymy and tautonymy might be considered at the same time; for in this matter simplicity and clearness are essential to avoid equivocation. Thus, for instance, if *Nasturtium Nasturtium-aquaticum* is a tautonym under the Rules (Art. 68-3), then the binomials *Asplenium Trichomanes* and *A. Trichomanes-dentatum* are a pair of homonyms; for a tautonym is nothing but a binomial where specific epithet is homonymous with the generic name (SPRAGUE's contention that *A. Trichomanes-dentatum* is "intrinsically invalid" under Art. 27 does not merit consideration cf. Furtado in Philipp. Journ. Sc. LXX, 1939, pp. 197-198). As numerous proposals have since been put forward regarding the orthography of botanical names, I may be excused for adding here a few more remarks on this subject (cf. also Furtado in Gard. Bull. Straits Settl. IX, 1937, pp. 249-255 and 256-258).

In the examples in Art. 70, *Sarauja* Willd. is said to be a typographic error for *Sarauia*, because WILLDENOW always adopted the latter spelling in his herbarium. This is a surprising statement, since in German (and WILLDENOW was a German) *i* and *j* have the same phonetic value, and in the manuscript *i* may be written where *j* would be employed in print. Both in German and later Latin *j* is preferred instead of *i* when it is at the beginning of a syllable. Thus *Jesus*, *Johannis*, *Juventus*, *Majus*, *Malaianus* and *Cujus* are used instead of *Iesus*, *Iohannis*, *Iuventus*, *Maius*, *Malaianus* and *Cuius*; and in dictionaries it was customary to list alphabetically under *I* all names commencing with *I* and *J*. Even in Linnean books one finds *Jacca*, *Jacobaea*, *Jasminum* and *Jatropha* indexed before *Ibiscus*, *Ilex*, *Impatiens* and *Ischaemum*, and the latter are followed by *Juglans*, *Juncus*, *Juniperus*, *Iva*, *Ixia* and *Ixora*. In view of this SARAUA (spelt with J) cannot be considered to be a typographic error, and has therefore to be adopted as correct.

In modern patronymics, it is better to form genitives as given in Recommendation XL (a) and (b) of the Rules, even when the word has a special genitival and adjectival form in Latin. It is better, for instance, to get from *Clemens* the forms *Clemensii* and *Clemensiae*, and adjectives *Clemensianus-a-um*, than to use *Clementis* which is the genitive for both genders and also an adjective; by employing the alternative Roman method of making personal names from adjectives, *Clementinii* and *Clementinae* (genitives) and adjectives *Clementinus-a-um* are obtained. Similarly in *Magnus*, which has a generic name *Magnusia* (see Rec. XXXIX-a), it should be preferable to have the

genitives *Magnusii* and *Magnusiae* and adjectives *Magnusianus-a-um* than *Magni* and *Magnae* and adjectives *Magnus-a-um* (which are confusable with ordinary adjectives). In modern patronymics if *Franciscus* and *Augustus* have yielded the generic names *Francisca* and *Augusta*, then the genitives should certainly be *Francisci*, *Franciscae* and *Augusti*, *Augustae*, with adjectives *Franciscanus-a-um* and *Augustanus-a-um* (or perhaps *Augustinus-a-um*). As to *Alexander*, the genitives *Alexanderi* and *Alexanderae* and the adjectives *Alexander(i)anus-a-um* would eliminate confusion with derivatives from the word *Alexandria*. In view of this the proposals made by GREEN (Kew Bull. 1939, pp. 325-236) to eliminate *Magnusii* from the example in Rec. XL (b) and to make other alterations seem to have been based on wrong conceptions.

The specific epithet in *Libertia Laurencei* Hook. f., was latinized according to the old method by substituting *u* for *w*. Here the original spelling seems to have been intentionally adopted. In the Rules (Art. 70) this example is given as a case of unintentional orthographic error, though it compares very well with *Clutia* where the spelling was intentional, though the word was derived from *Chuyt*, and *Chuytia* was subsequently proposed as the correct spelling of the name.

## 29. Tautonyms and Generic Homonyms

While dealing with "Tautonyms and Homonyms" in Gard. Bull. Straits Settl. IX (1937) 249-253, I submitted that the rules regarding tautonyms and generic homonyms were so constructed as to mislead even the best nomenclaturists. I quoted the decisions given by some leading nomenclaturists in Kew Bull. (1935) 341-544 to show "a complete absence of uniformity in principles". In some cases earlier names have been rejected apparently as "superfluous" (despite their clear validity), in order to make room for admitting exactly similar later names as non-homonymous, legitimate names. *Wendtia* DC. (1830), for instance, has been rejected because it was an unwarranted correction of *Wendia* Hoffm. (1814), and so *Wendtia* Meyen (1834) has been accepted as the legitimate, non-homonymous name for another group. More recently, contradictory decisions have been given by ENSIGN in Amer. Midl. Nat. XXVII (1942) 501-511 and HAROLD ST. JOHN in Proceed. Biol. Soc. Washington LV (1942) 109-112 in the case of *Glossopetalum* Schreber (1789) and *Glossopetalon* A. Gray (1853). Such conflicting views are

possible because the Rules are not clear on these points. As to generic homonyms, I shall let St. JOHN speak:

This [Art. 70] expands the brief, definite provisions of the earlier Vienna (1905) Rules, introducing qualifications and many examples. Unfortunately, some of these examples were ill chosen, and as listed partially confuse the applications of the law. Many times the writer has studied this new wording and he has tabulated the examples hoping to find complete agreement and clarity, but in vain. (op. cit., p. 110).

Further, since a tautonym is a specific name with its specific epithet homonymous with the generic name, and since little variations in specific epithets do not create new distinct epithets, the rule that outlaws tautonyms has been also one of the fruitful causes of conflicting decisions in nomenclature (cf. Furtado in Gard. Bull. Straits Settl. IX. 1937, pp. 249-255, and also *Bambos Bambos* and *Bambusa Bambos*). I have therefore proposed the deletion of the rule altogether so that tautonyms should be valid in future (Gard. Bull. Straits Settl. XI, 1937, pp. 4-7). But in order to get at the bottom of the principle involved in the examples of generic orthographic variants and homonyms, it would be better (despite St. JOHN's remarks) to analyse here the names which, though having the appearance of homonyms, have been quoted in the Rules as examples of different, non-homonymous generic names:—

1. RUBIA: a feminine noun derived from the Latin *ruber-rarum*, meaning red.  
RUBUS: a Latin name for blackberry, masculine in form.
2. MONOCHAETE: a proper noun from Greek *mono* (one) and *chaete* (flowing hair), feminine.  
MONOCHAETUM: a latinized adjective, neuter in form, from *monochaetus-a-um* (with flowing hair) used as an adjectival noun.
3. PEPONIA: feminine form of *peponius-a-um* from *Pepo* (a pumpkin).  
PEPONIUM: a neuter form of *peponius-a-um*.
4. IRIS: A Greek plant name, feminine.  
IRIA: probably a Malabar plant name, feminine.
5. DESMOSTACHYS: a proper noun from *desmos* (bond) and *stachys* (ear of corn), masculine in form.  
DESMOSTACHYA: an adjectival noun, feminine in form, from latinized adjective *desmostachyus-a-um*.
6. SYMPHYSTEMON: from *symphysis* meaning to grow together, coalesce.  
SYMPHOSTEMON: from Greek *symphys* meaning to bring together, cause to grow together.
7. GERRARDINA: from a Natal plant-collector, GERRARD.  
GERARDIINA: from *Gerardius*, a latinization of LOUIS GERARD.
8. DURVILLEA: from J. E. C. D'URVILLE, the preposition having been joined to the surname that follows.  
URVILLEA: from J. E. C. D'URVILLE, but the preposition preceding the name is omitted.

9. ELODES: a masculine noun from Greek adjective *helodes* (marshy).  
ELODEA: a feminine noun from Greek adjective *helodes*.
10. PELTOPHORUS: a masculine form from *peltophorus-a-um*.  
PELTOPHORUM: a neuter form from *peltophorus-a-um*.

None of these are therefore merely orthographic variants of the same name like *Phoradendron* and *Phoradendrum*, *Anadendron* and *Anadendrum* and *Dysoxylon* and *Dysoxylum*, in which the second form is nothing but the first name with its termination latinized, and both retaining the same derivation and gender. Such names, though not mentioned in the examples as orthographic variants under Art. 70, are mentioned as examples of the two different spellings of the same name in Art. 71 (3) where *Rhododendron* and *Rhododendrum* are given as examples. Perhaps the phrase "and other epithets" in Art. 70 (4) was meant to cover these variants also. The Rochester Code, which retains the generic names even when they differ slightly unless this difference be due to "the spelling of the same word", gives *Epidendron* and *Epidendrum*, *Astero-carpus* and *Astrocarpus* as examples of orthographic variants, but quotes *Apios* and *Apium* as examples of good, non-homonymous generic names, presumably because of their different gender. The names *Anodendron* DC. (1844) (Apocynaceae) and *Anadendron* Schott (1857) (Araceae) are somewhat on a different footing, the prefixes being derived from two different Greek words, though both having almost the same meaning: *ano* (upwards) *ana* (up). These two names have always been considered as good non-homonymous generic names, though they are not mentioned as examples in the Rules.

In view of this it would avoid confusion if Art. 70 were amended so as to include both Art. 71 and the principles deduced above. At present those who consult Art. 70 overlook the fact that that rule is not complete without Art. 71. The pertinent clause affecting the generic names discussed here could be stated thus:

Art. 70 Note 4(a): Generic names of Greek origin differing merely by having Greek and Latin terminations respectively, but involving no change in gender or parts of speech are orthographic variants or homonymous names; where a change in terminations indicates a difference in gender or accident, the generic names must be considered as different, non-homonymous names.

This modification would clarify the rule of generic homonyms and would call for a revision in the nomenclatural decisions given by the different experts in Kew Bull. (1935) 341-544 (see my aforementioned paper 1937). It would also show that *Glossopetalum* Schreber (1789) and *Glossopetalon* A. Gray (1853) are homonymous names, being the

same name used twice in different senses. Though the former is unusable, being a later synonym of *Goupia* Aubl. (1775), the conservation of the latter is undesirable because both homonymous names are of the same family Celastraceae and occur in neighbouring regions, Mexico and Guiana. These two reasons combined would have been sufficient to demand the rejection of one of the two names even if they were not homonyms, in order to avoid errors, confusion and ambiguity in any treatment of the plants. In view of this, *Forsellesia* E. L. Greene (1893) is the correct name for *Glossopetalon* A. Gray. This decision accords with the treatment given by ENSIGN (1942), but conflicts with that given by ST. JOHN (1942).

### 30. Proposed Amendments to the Rules of Nomenclature

[Where the letter *A* follows the number of an Article, the amendment refers to the text of that Article in the existing Rules. Where other letters are used, the amendments are additions to, or transpositions of, the Rules. Where a letter is followed by *bis*, the amendment or addition refers to the Article amended in my previous Proposals in Gard. Bull. Straits Settl. XI, 1939, pp. 1-30. The Discussions with numbers refer to the Discussion preceding the Amendments in the present publication].

**ART. 1A: ADD:** The precise system of nomenclature on which an international agreement has been secured shall be known as the LINNEAN SYSTEM OF BOTANICAL NOMENCLATURE, hereinafter referred to merely as the LINNEAN, BINARY or BINOMIAL SYSTEM. This system is generally biverbal for species.

[Various designations are in use to name species, but nowhere in the Rules has the system been named. This addition meets the deficiency].

**ADD: NOTE 1:** (a) A *binary* name denotes two concepts, the first generic and the second specific; under the Rules these two concepts must be associated with two separate descriptions, though under certain conditions these two descriptions may be combined into one (*descriptio generico-specifica*).

(b) A *binomial* is a combination of two epithets, each of which stands in place of a description. The terms *binomial* and *binominal* are interchangeable.

(c) A *biverbal* name consists of two words; sometimes each word may be formed of two words united with a hyphen.

**Examples:** The consistent employment of binary binomials for species began in Linnaeus, *Species Plantarum* (1753); only occasionally these binomials are not biverbals (the Rules have

provided for making them biverbal names). Many varietal names in GANDOGGER's *Flora Europæ* are biverbal binomials, but are not binary, because, though the first epithet stands for a generic description, the second stands for the description of a variety. Many specific names in HILL's *Herbal* are binary biverbals, but not binomials; many others are binary but neither biverbal nor binomial.

**ART. 2B bis: REVISE:** The *rules* are divisible into three main categories according as they pertain to (a) validity, (b) legitimacy, and (c) propriety of names.

(a) The *validity* rules determine when a name shall have a claim to recognition by botanists, and so they treat of: (i) the admissible order of the different categories of taxonomic groups; (ii) the formation of names to denote these different categories; (iii) the nature of the description or citation with which a name or its epithet is to be associated; and (iv) the nature of the publication wherein the descriptions and names are published. Names instated in violation of any one of these rules are *invalid*, having no status under the Rules (Art. 19A).

(b) The *legitimacy* rules decide the correct name for a given taxonomic group in given circumstances (Art. 16A), and so deal (i) with the priorability and impriorability of names and epithets (Arts. 52B-F'), (ii) with the use of a name or epithet on transference of a taxonomic group from one nomenclatural position to another (Art. 53A bis), and (iii) with the claims of two or more priorable names or epithets for the same taxonomic group (Art. 56A bis.). Names in use contrary to any one of these rules are *illegitimate*.

(c) The *propriety* rules decide (i) the correct spelling of names and epithets, (ii) the correct gender of these names and epithets, and (iii) the correct manner of citing the names both of the author who first validated the names and epithets denoting the taxonomic groups, and of the author who first placed the epithets in their correct position. Nomenclatorial expressions offending any of these rules will be *improper*; these offences affect neither the validity nor the legitimacy of the names and epithets.

## ARTS. 10-12

[Arts. 10-12 must be revised. Nomenclature does not deal with individual plants as individuals; they are dealt with as representative of taxonomic groups. In Art. 18 the lowest representative of a taxonomic group is the type specimen. For

reasons stated in Discussions 13-14 and 17 references to *individuum*, wild plants, hybrids, etc. are eliminated from the Rules as amended below].

**ART. 10A: REVISE:** The classification under the Linnean system so far recognizes the following ranks or categories of taxonomic groups enumerated in their descending order: Regnum vegetabile, Divisio, Subdivisio, Classis, Subclassis, Ordo, Subordo, Familia, Subfamilia, Tribus, Subtribus, Genus, Subgenus, Sectio, Subsectio, Species, Subspecies, Varietas, Subvarietas, Forma and Subforma.

**NOTE 1:** If this list of categories is insufficient, it may be augmented by the intercalation of supplementary categories provided that this does not introduce confusion or error.

**Examples:** *Series* and *Subseries* are categories which may be intercalated between section and species.

**NOTE 2:** (a) These categories of groups shall be classified philosophically as follows: NECESSARY (essential to the binary binomial system) and ACCESSORY (non-essential to the system). The Necessary groups may again be divided into FUNDAMENTAL and NON-FUNDAMENTAL; and the Accessory into SUBDIVISIONARY and DISJUNCTIVE.

(b) The FUNDAMENTAL NECESSARY groups are the Genus and the Species; only on these two the entire binomial system has been built. The NON-FUNDAMENTAL NECESSARY groups are family, order, class and divisio; at one time these groups did not exist in the Linnean system, though now they are necessary to phylogenetic taxonomy of the Fundamental groups.

(c) The ACCESSORY groups, though not essential to the system, are useful. The SUBDIVISIONARY groups divide a superior group into *two or more* parts in order to show the affinities of the inferior groups under the superior group; a Subdivisionary group itself is permitted to be again divided and subdivided into subordinate groups according to convenience (Note 1). Subdivisionary groups can never be less than two under their immediate superior group. Prior to 1930 Subspecies were both Subdivisionary and Necessary, but now they are only Subdivisionary groups (Art. 37A bis Note 5).

(d) DISJUNCTIVE groups, which include varieties and subvarieties, represent minor *deviations* from

the standard established by the type specimen, varieties being minor deviations from the species *sensu stricto*, and subvarieties from varieties *sensu stricto*.

Forms and Subforms (which are distinguished on characters either permanent and hereditary, or transient, or acquired under special conditions), may be distinguished as *forma* and *subforma biologica, specialis, juvenilis, adulta, cultigena, hybrida, apomicta, choronomica*, etc. These are not taxonomic groups in the proper sense of the word, and their names being admitted as special subjects to the nomenclatural rules, shall not interfere with the priority or homonymy of the names of superior groups.

**Rec:** I and II are to be retained.

**ARTS. 11-13: DELETE.** Incorporated in Art. 10A and in Art. 2B bis.

**ART. 14: DELETE.** See Discussion 14, and also remarks on Arts. 10-12 above.

**ART. 18A bis: DELETE** the last sentence of the first para. (See Discussion 18).

**TRANSFER** the second para. with the examples to Art. 50B; it forms a special rule.

**REVISE** the first sentence of the NOTE as follows: "The nomenclatural type does not necessarily represent a group which is genetically the most simple, phylogenetically the most ancient, ecologically the most common, taxonomically most polymorphic, or physiologically the most perfect." (See Discussions 19-21 & 25 and Art. 20A).

**Rec: IV, V and VI: TRANSFER** to Art. 50B as Rec. XXXIIB, XXXIIC & XXXIID.

**Rec: VIIA: OMIT** the word ("type") (Discussion 17).

**ART. 19A bis: ADD:** "Note 1. The generic and/or specific names from works wherein genera and species have been treated in an unorthodox terminology on philosophical grounds but have nevertheless been given the correct forms of botanical names, shall be admitted as valid under the Rules, provided they were so admitted by contemporary botanists, or in the subsequent editions of Linnaeus Sp. Plantarum. The same principle shall be applied to the names of other taxonomic groups."

**Examples:** (1) NECKER's philosophical ideas on classification are rejected because he called the Linnean genera and species as species and proles respectively; but NECKER's names for the Linnean taxonomic groups (genera) were correctly formed and admitted as valid by contemporary

botanists. These generic names shall therefore be admitted as valid under these Rules. The same principle applies to ADANSON's genera.

(2) FRIES's sectional or subgeneric names are in the correct form and were admitted as valid by contemporaries, though FRIES had called his subgeneric subdivisions "tribus". Hence they shall be accepted as valid under the Rules provided they satisfy other provisions for validity.

**ART. 20A bis:** Revise the last sentence after the clause (*h*) as follows: Note 1: The generic and specific names in works adopted as the starting points of nomenclature for the different groups of plants shall be treated as valid, even when they are unaccompanied by any description, an exception being made only of those names that are not correctly formed. Reference in such works to generic and specific descriptions published previously under the same name or another are invalid. For the purpose of typification, however, it is allowed to associate the Linnean genera in *Species Plantarum* (1753) and (1762-63) with their *first subsequent* descriptions in *Linnaeus's Genera Plantarum* (1754) and (1764), provided this does not disturb an already accepted typification based on any one of the specific components in 1753 and 1762-63 as the case may be. [Discussions 19-21 and 25].

**ART. 25A bis:** READ "admissible" for "valid" in the sentence: "But no generic name is valid unless:"

**ART. 27A bis:** READ "admissible" for "valid" in the sentence: "But no specific epithet is valid unless:"

**ART. 28A bis:** OMIT the words "of wild plants" in the first line of the second paragraph (Discussions 13 and 14).

REVISE the last two sentences in second paragraph thus: "The use of a binomial nomenclature for subordinate groups of a species is not admissible, nor is it permissible to reduce more complicated names to trinomials except by removing subspecific epithets, and the conventional epithets used to denote a group *sensu stricto*. In the case of the names of forma and subforma, the epithets denoting subspecies may not be omitted.

DELETE the examples of *Saxifraga aizoon* subforma *surculosa* as it is misleading. [Discussions 4, 5, 7, 10 and 11].

**ADD:** "NOTE 1: Binomials published before 1905 as varietal names shall have a valid status only as ternary names obtained by linking the varietal (second) epithet to the

specific name under which the variety is established; the varietal binomials themselves, being invalid, are no obstacles to the priorability of their specific homonyms.

**Examples:** *Petroselinum sativum* Hoffm. var. *P. crispum* (Mill.) Nym., Consp. Fl. Eur. (1879) 309 shall be considered as having been published as *P. sativum* var. *crispum* (Mill.) Nym. GANDOGGER's varietal binomials must be considered as having been published as ternary varietal names. As binomials they shall have no standing under the Rules.

[The rejection of varietal names published under the old system does not contribute to the clarity of the subject. No confusion would result if priority were allowed to these varietal epithets within their superior group. Discussions 7-9, 11 and 13].

**ART. 28B bis:** REVISE the first sentence: "No varietal or subvarietal epithet having a valid status shall denote the species *sensu stricto* (i.e. the taxonomic form represented by the type specimen)."

**READ:** "NOTE 1" for "Note" and at the end of the Note **ADD:** (*see* Rec. XXXV).

**ADD:** "NOTE 2: Two subordinate groups of the same species may not bear the same epithet in the same position. No subdivisionary or disjunctive group may bear the epithet of its immediately superior group, unless it includes the type of its immediately superior group. This rule also applies even when the epithets are preceded by such conventional prefixes as *Eu*."

**Examples:** TRANSFER here the examples under Art. 30 but amend the wording of the second example as follows:

"The following is incorrect: *Erysimum hieracifolium* subsp. *strictum* var. *longisiliquum* and *E. hieracifolium* subsp. *pannonicum* var. *longisiliquum*; the subspecific epithets being omissible, the varietal names are homonymous (*see* Art. 37A bis-5).

**ADD:** The expression *Andropogon Sorghum* subsp. *Sorghum* or *A. Sorghum* var. *Sorghum* is permissible (as a practical device) to denote only the type form of *A. Sorghum*. [Discussions 5-7, 9 and 11].

**ART. 29:** DELETE [This is self-evident because no homonymy is created].

**REC. XIXB:** Botanists are advised to follow the horticultural rules when dealing with cultural and hybrid forms which cannot be segregated taxonomically.

**ARTS. 31-35:** TRANSFER to Appendix VII. [Discussions 13 and 14].

**SECTION 5A:** REVISE: "Conditions of Valid Publication of Literature."

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**ART. 36A bis:** Subject to Art. 20A bis, literature shall be valid only if it is printed or indelibly autographed and made available to the botanical public by sale, exchange, or distribution.

**NOTE 1:** From 1950 no publication shall be valid unless one hundred (100) copies at least are made available to the botanical public by sale, exchange, and/or distribution.

**NOTE 2:** Publication by issue of separates is not valid unless their distribution satisfies the general conditions for valid publication (see Note 1).

**NOTE 3:** From 1950 no systematic papers issued in non-botanical works or periodicals shall be valid unless they are also available to the botanical public in the form of separates.

**NOTE 4:** From 1950 seed-lists, indexes, herbarium labels, nomenclators, garden catalogues, floras for schools and colleges, plant introduction lists, and journals and books dealing with economic botany, shall be deemed as non-botanical works or periodicals for the purpose of this rule.

**NOTE 5:** The botanical public means institutions and botanists interested in systematic botany.

[The use of different terminology in different Articles to mean the same thing is often confusing. The present revision conforms with the terminology in Arts. 20A and 37A. See also remarks under Art. 36A in 1939 and Discussion 27].

**RECOMMENDATION XXB:** Botanists are advised to publish new nomenclatural entities in botanical monographs or periodicals, and are further recommended to indicate by means of special signs and types all new nomenclatural entities in the index or in an abstract accompanying the paper.

**SECTION 6A: DELETE:** "and dates" from the title of this Section.

[Rules concerning dates are put together with priorability in Section 9].

**ART. 37A bis: AMEND (b):** "by reference to a previously published valid description of a co-ordinate group (Note 4).

**NOTE 2 bis: REVISE:** The indication of the type locality, the peculiar habitat, or parentage or ancestry of a taxonomic group shall not be sufficient to establish a name under this rule. If descriptive characters are given, the type locality or the habit indicated shall become a part of the description and so shall form an

important element in determining the identity of the taxonomic group. However, economic uses, vernacular names, parentage or phylogeny (individually or together) shall not become a part of the description of the new entity, even when this entity be of cultural or hybrid origin.

[Characters mentioned in the last category are not observed in the field. Often information given by guides is erroneous, as also speculation regarding parentage, phylogeny or ancestry].

**NOTE 4 (b) bis: REVISE:** "For the purpose of this rule, the members in each of the following groups shall be considered as being co-ordinate:

(i) Divisio and its subdivisions; (ii) Class and its subdivisions; (iii) Order and its subdivisions; (iv) Family and its subdivisions; (v) Genus and its subdivisions; (vi) Species and Subspecies; (vii) Variety and subvarieties within the same species and (viii) Formæ and Subformæ within their immediate superior group.

**ART. 37A bis: NOTE 4 (c) bis: REVISE:** In the case of a new monotypic genus, *reference* shall be allowed to the generic description in validating the name of its species, it being also permitted to give the description of the genus under the binomial of the species (*descriptio generico-specifica*).

**ADD: NOTE 4 (d):** In validating the name of a variety, subvariety, forma or subforma, reference shall be allowed to the description of any species or subspecies, but the converse shall not be allowed. Reference to the description of a variety and other subordinate groups shall not be allowed to validate a subordinate group of equal or lower rank outside the species, except when this species or its subspecies is the isonym or the basynym of the one under which the varietal or infra-varietal epithets are to be instated or were instated.

[Disjunctive groups being subordinate deviations from the standard receiving a superior name, are not easily fitted in as similar deviations of another standard unless defined again. Furthermore, varietal and specific differences are not co-ordinate.—See Discussions 4, 5, 8, 9 and 10].

**Example:** (1) *Glossopetalum pungens* Brandg. var. *glabra* (Ensign) H. St. John in Proc. Biol. Soc. Wash. LV (1942) is valid because the basynym of the variety was instated under *Forsellesia pungens* (Brandg.) Heller which is an isonym of *G. pungens* Brandg., the basynym of the variety being *F. pungens* var. *glabra* Ensign in Amer. Midl. Nat. XXVII (1942) 503.

(2) *Hemigramma Zollingeri* var. *major* Christ in Philipp. Journ. Sc. II (1907) 170 shall not be considered as the isonym of *Hemionitis gymnopteroides* forma *major* Copel., though the latter was considered as the basonym. The protologue of the variety therefore is the description and the syntype cited by CHRIST. See also examples under Notes 6 and 8 under Art. 51A.

**ART. 37A bis: NOTE 4 (e):** *Reference* to a description a defect of which rendered its name invalid shall not be able to validate the same or another name; for such a name to be valid a new description must be given.

**Example 1:** The names, *Neurotecoma* Schum. and *Spirotecoma* Baill., were invalid when published, the former because it was provisional and the latter because it was undescribed. DALLA TORRE et HARMS (1905) considered both these names as valid and listed the former in the synonymy of the latter which was earlier; this listing shall not be taken as the valid publication of *Spirotecoma* by reference to *Neurotecoma*, since the description of the latter was so defective as to render it invalid. [For discussion of this case see Furtado Provisional Names, in Gard. Bull. Straits Settl. IX, 1937, pp. 230-232; Discussion 25].

**Example 2:** *Leopoldia* was proposed as a provisional name by HERBERT in Bot. Mag. (1820) t. 2113, p. 5 footnote, to be adopted should certain circumstances prove true. The name did not become valid when it was mentioned in a letter in Trans. Hort. Soc. London IV (1821) 181 indicating that the plants of the group required certain cultural conditions.

[It is also invalid under the existing rule 37A (3) = Art. 42 (2) which interdicts references to the description under the same name. See Discussion 25].

**NOTE 4 (f):** No *reference* to a misapplication or misinterpretation of a name shall validate a name, even when there is available under the misapplied name a lengthy description based in part at least on new specimens. [Discussion 18].

**NOTE 5 (a):** TRANSFER here Art. 40A and ADD: "However names of subspecies published before 1930 shall be a special case of alternative names where the isonyms and the basonyms are of unequal rank; they shall be the names of subdivisions (= subspecies) of a species sensu amplissimo and at the same time specific names of the microspecific groups. [Discussion 7].

**NOTE 5 (b):** Where Note 5 (a) applies, the alternative specific binomial for the subspecies shall be obtained by omitting the intercalating epithet between the generic name and the subspecific epithet; and if published as a specific binomial, the alternative subspecific trinomial shall be obtained by joining the epithet denoting the subspecies to the binomial denoting the metrospecies.

**NOTE 5 (c):** Where Note 5 (a) applies, the varieties and other subordinate groups published under a subspecies shall become ipso facto varieties and subvarieties under the alternative specific name.

**NOTE 5 (d):** Since in all cases the intercalating epithets denoting the subdivisionary groups may be omitted, the varieties and subvarieties instated under a subspecies shall also be varieties and subvarieties under the species sensu amplissimo. This does not apply to formæ and subformæ which remain under the special group in which they are instated, the epithet var. *typica* or its equivalent being omissible.  
[cf. Discussions 4–7, 10 and 11].

**NOTE 6:** TRANSFER here Art. 40B.

**NOTE 7:** TRANSFER here Art. 41A.

**ART. 45A: DELETE:** it is transferred to Art. 52C in Section 9.

**ART. 49A: REVISE:** "When a name or epithet of a taxonomic group is retained after transferring it to a new position or rank, the name of the original author must be cited in parenthesis, followed by the name of the author who effected the transference, provided such a transference is allowed (see Art. 37A bis). If the transfer is not allowed, the instatement of the name or epithet in the new position or rank shall be invalid unless accompanied by a new description; in the latter case, the author who supplied the new description shall be cited.

[Reasons have already been adduced for limiting the references permissible in Art. 37A bis. Hence the amendment is needed here also. In addition, some verbal alterations were needed since "or a group of lower rank" at the beginning of Art. 49 could have been interpreted to render a part of the second sentence unnecessary or superfluous. The amendment also takes into consideration that the priorability is limited in the case of names of subdivisionary and disjunctive classes. See Discussions 6, 7, 8, 9 and 13–14].

**SECTION 8A: ADD** "Typification and" *before* the existing title.

**ART. 50B bis: REVISE:** "The type of the name of an Order or Suborder is a Family, that of the name of a Family, Tribe or Subtribe is a Genus, and that of the name of a Genus, a Species, or a group of lower rank, is usually a specimen or preparation. Where a new species includes the type-specimen of a simultaneously published genus, the type of the genus. and the type of the species shall be identical; the name of the species shall

then be retained to the generic type. Where the name of the species that includes the type of a new genus is an isonym of a previous name, the type of the new genus and the type of the isonym may not be identical; and so the genus may be so split as not to retain the specific isonym under it. Where permanent preservation of a specimen or preparation is impossible, the application of the name of a genus and other subordinate groups is determined by means of an original description or figure.

**NOTE 1:** No name may be used for a supra-generic group if it is taken from the name of a genus not retained under the group even as a synonym.

[This combines the second part of Art. 18, and Art. 66. Other changes were required because in many cases the so-called "type" species is not the type of the genus. cf. also Discussions 17 and 18].

**Examples:** TRANSFER here the example under Art. 18, but DELETE "and description" in the third line. TRANSFER here also the examples from Art. 66. [Discussions 19-21, and Art. 20A].

**REC. XXXIB:** TRANSFER here REC. IV after DELETING "the subdivision which is" in the first sentence and after ADDING "or type-specimen" after "type-species" and SUBSTITUTING the word "type" for "type-variety or" in the second line.

**REC. XXXIC:** TRANSFER here REC. V after SUBSTITUTING "When subdividing or splitting a genus" for "When revising a genus", and ADDING "or specimen" after "species".

[The word "revise" is used in a different sense in taxonomy, and revisers do not usually have opportunities to indicate lectotypes. Except in splitting or subdividing a group, revisers should not attempt to select lectotypes for fear of misdirecting future investigations. Discussions 17-21].

**REC. XXXID:** TRANSFER here Rec. VI [Discussion 3].

**ART. 51A: REVISE:** "When an author has included under one taxonomic group two or more different elements (a *mixtum compositum*) and no holotype has been indicated, the first subsequent author who recognises the mixed composition of the group and selects a lectotype on adequate botanical reasons (Art. 22B and Note 1 below), or transfers the discordant elements to another taxonomic group, shall be followed, provided the name is retained to one of the original elements (see Art. 20A bis Note 1 and Art. 50B bis). If the name has not been retained to any of the original

syntypes, it must be re-established to one of them. Where the holotype has been indicated even indirectly, the name must be retained to it except in cases indicated in the Notes below.

**ART. 51A: NOTE 1:** If two or more interpretations are possible, and if no syntypes are available, or when available are inadequate for the correct interpretation of the taxonomic group (a negative *mixtum compositum*), the neotype shall be so selected as to defend the earliest interpretation that agrees with the general plant-geographical and descriptive considerations and keeps the major group in the position assigned by the author (see Art. 22B).

**Example:** TRANSFER here examples from Arts. 51 and 52, and ADD:

*Rhus filicina* DC (1825) was based on two unpublished drawings (Ic. 189 and 217) and on two manuscript species based on these drawings (*R. filicina* and *R. Tetlaziam*), both of which were regarded by DE CANDOLLE as conspecific. The manuscript species and the drawings were all by SESSE and MOCINO. About 50 years later, Ic. no. 189 was printed and published as being the type of *R. filicina*. This drawing is not well made and appears to be of a plant with bi- and tri-pinnate leaves. On this character the species has been regarded as conspecific with *Amyris bipinnata* Sesse et Mocino, Ic. 197 ex DC. (1825) (the basynym of *Bursera bipinnata* (DC.) Engl., 1881), the implication being that DE CANDOLLE had made a mistake in describing the leaves. Others, however, disagree with this reduction and suppose that the leaf characters may have been badly drawn by DE CANDOLLE's artist, who had to copy hurriedly from SESSE and MOCINO's original drawings. These maintain that the clear description of the leaves and of the fruits admit no doubt as to its identity as a species of *Rhus* as understood by DE CANDOLLE, and not *Bursera bipinnata*. (For controversy cf. Barkley in Ann. Missouri Bot. Gard. XXIV, 1937, pp. 1-10 et 3 pl; Barkley and Reed in Amer. Midl. Nat. XXI, 1939, pp. 368-377; Bullock in Kew Bull. 1937, pp. 440-441 and 1939, pp. 337-339).

In Ic. 189 no fruit is represented, and flowers are too poor for any generic identification. The facts that DE CANDOLLE described the fruit of the species, mentioned the vernacular name *Tetlaziam*, and stated that the species has simple imparipinnate leaves with pinnatifid sessile leaflets, lead one to typify *R. filicina* D.C. (1825) on the second syntype, namely, *R. Tetlaziam* Sesse et Mocino msc Ic. 217 (ined); for this syntype agrees well with all the characters mentioned by DE CANDOLLE, and it is also the one that has a fruit. Hence this syntype must be the lectotype of *R. filicina* (Barkley has indicated a neotype cf. example 3 under Note 3 below).

[N.B. Those who typify the species on Ic. 189, alleging that the species was based "primarily" on Ic. 189, and not Ic. 217, overlook the fact that *R. filicina* as published in 1825 was not *R. filicina* Sesse et Mocino in vel apud DC., but *R. filicina* Sesse et Mocino ex DC., the latter expression being equivalent to *R. filicina* DC. Hence in typifying the species,

DE CANDOLLE's syntypes, and not SESSE and MOCINO's holotype, should be considered. In 1874 only Ic. 189 was published, apparently because it was the type of the manuscript name, but unfortunately it is the syntype that has to be excluded from the mixtum compositum. This is a good instance of a misdirection of studies by publishing in 1874 only one drawing (instead of two) as the type of *R. filicina*, and justifies my protest "against unnecessary alterations being made in the status of the syntypes even when the changes made are by the author of the species himself." (Gard. Bull. Straits Settl. IX, 1937, pp. 296-299)].

**ART. 51A: NOTE 2:** Notes left by the author on herbarium sheets shall not be used to discredit a typification previously made. Such notes, however, may be employed to supplement the published data and in selecting a lectotype if none has been previously indicated (either directly or indirectly). This lectotype may be chosen only when the current interpretation is not clear and does not accord with the general plant-geographical and descriptive considerations. [cf. Discussions 20-21].

**NOTE 3:** If a new genus is based on new specimens but an old species has been indicated as the type, and if it is found that the indicated type species is generically or specifically different from the new type specimens studied, the new genus shall then be typified on the new specimens on which the generic description was based [Discussion 17].

**Example 1:** The genus *Binghamia* Britt. et Rose in Cactaceae II (1920) 167 was created to receive two old species, *Cephalocereus melanostele* Vaupel (1913) and *Cereus acanthus* Vaupel (1913). The two isonyms instated under the new genus were *B. melanostele* and *B. acantha*, the former being indicated as the type species of the new genus. But, as pointed out by BULLOCK in Kew Bull. (1938) 454-458, there is no evidence that the authors actually saw the type of the species indicated as the type of the genus; and it is evident that the genus was based on newer material which, because of the similarity of habit and also because of its occurrence in the type-locality, was mistaken for *C. melanostele* Vaupel. The latter, being a species of *Euphorbia* Britt. et Rose in Cactaceae II (1920) 60, has yielded the new isonym *E. melanostele* (Vaupel) Bullock (1938). But, despite this transference of the indicated type species of *Binghamia*, the latter genus does not become a synonym of *Euphorbia*; for *Binghamia* is to be typified on the actual material on which the generic description was based, though mistaken for *C. melanostele*. This material has been shown to be conspecific with *Cereus* (Sect. *Binghamia*) *pseudomelanostele* Wedermann et Blackeberg in Neue Kakteen (1931) 74-75 (quoted by Bullock), and so the new combination has been rightly instated by BULLOCK as *Binghamia pseudomelanostele* (Wederm. et Blackeb.) Bullock (1938). The type specimens of this species and those of the genus, though conspecific, are not identical.

**Example 2:** In instating *Goniophlebium* Presl (1836), an original generic description was given, and two out of the five species were figured. These two species (the only ones seen by Presl) were from America. PRESL also cited under the genus, *Polypodium* sect. *Goniophlebium* Bl. (1830); but all three of BLUME's species were cited with some doubt, and with the following explanatory note: "Species Blumeanas non vidi et solummodo ex auctoritate clar. Blume huc retuli." The fact that PRESL referred all the syntypes of BLUME's section doubtfully to his genus is important because no genus can be typified on the species or specimens which have been referred doubtfully to it. PRESL was free to use any name for his genus, and the fact that he typified the genus on the specimens studied by him is an important point to bear in mind. Had he also included the specimens and the species of BLUME without expressing any doubt, the genus would have had to be typified as in the case of Example 1. But, as it is, the case is quite clear: the genus must be typified on the American syntypes studied and described by PRESL.

[In *Genera Filicum* (1947 p. 181) COPELAND writes that PRESL could not take the name from BLUME without also taking "whatever type of BLUME properly went with the name." Yet in discussing *Anapausia*, COPELAND (op. cit. p. 132) writes: "In general, when the status of a group is changed, as from a section to a genus, its type goes with it. But in this particular case, in publishing *Anapausia* as a genus, PRESL cited "*Gymnopteris* §2 *Anapausia* Presl (excl. speciebus)". So COPELAND does not accept the type of the Section as the type of the genus *Anapausia*. What is allowed in one case should also be allowed in the other].

**Example 3:** In establishing the monotypic genus *Actinocheita*, BARKLEY (Ann. Miss. Bot. Gard. XXIV, 1937, pp. 1-10 et 3 pl.) supposed that the *syntype* Ic. 189 of *Rhus filicina* DC. (1825) was somewhat misdrawn by the artist, but, because of the description of the leaves and the fruit, typified the species on *Pringle* 4752 (a neotype). From this neotype BARKLEY drew the principal characters of the genus. Hence the genus must be typified on *Pringle* 4752, and the "type" species should include that specimen.

[BULLOCK in Kew Bull. (1937) 440-441 and (1939) 337-339 has advocated that the type of this genus should be *Rhus potentilifolia* Turcz with *Galeoti* 4006A as the type, and, therefore, he has made the new combination *A. potentilifolia* (Turcz.) Bullock. Against this BARKLEY (l.c.) and BARKLEY and REED (Amer. Midl. Nat. XXI (1939) 368-377, quoted by Bullock) have argued that the genus should be typified on *Rhus filicina* DC. with Ic. 189 as the type, suggesting that, if this type is not retained, the genus should receive another name. Hence the type species is called *A. filicina* (DC.) Barkley. But in the example discussed under the foregoing *Note 1*, it has been shown that *R. filicina* DC. should be typified on Ic. 217, the manuscript type of *R. Tetlaxium* Sesse et Mocino msc. Thus typified *R. filicina* DC. becomes conspecific with *Pringle* 4752. The correct name for the species that includes the type of *Actinocheita* is, therefore, *A. filicina* (DC.) Barkley *emend.* Furtado].

**Example 4:** *Hemigramma* Christ in Philipp. Journ. Sc. II (1907) was established as a monotypic genus with *H. Zollingeri* (Kurz) Christ (*Heminiotis Zollingeri* Kurz) as the species,

and with *H. Zollingeri* var. *major* (Copel.) Christ as a variety. CHRIST excluded from the genus *Leptochilus latifolius* (Meyen) Christ (*Gymnopteris taccacfolia* Sm. and *G. latifolia* Meyen). Now it is maintained that *G. latifolia* is identical with *H. Zollingeri* and that therefore the type species of *Hemigramma* should be *H. latifolia* (Meyen) Copel. (1907) (*G. latifolia* Meyen), that is, precisely the species that was explicitly excluded from the genus.

Actually the genus was described from new specimens studied by CHRIST, namely: (1) from "Batavia, Java, ex Herb. Hort. Bot. Bogor., and from Celebes, leg. Sarasin" with which KURZ's figure was compared, and (2) from the Philippines cited under the var. *major*. In typifying the genus all these specimens must be considered, and not only those cited under the variety, as has been suggested by COPELAND in Science LXIX (1939) 328. Under certain circumstances *H. latifolia* may be the legitimate (correct) name for the species that includes the lectotype of the genus, but the genus must not be typified on the type of this species (cf. also Copeland, Gen. Filicum, 1947, p. 131.).

**ART. 51A: NOTE 4:** In Fungi Caeteri all the genera and the species instated validly for the first time in FRIES'S Systema Mycologicum (1821-32) shall be typified on the descriptions given, and the specimens and the figures cited or implied by FRIES, the discoverer of a mixtum compositum being free to choose any one of these as the lectotype. However, a genus or species validly instated for the first time by another author after the issue of the first part of Systema (1821), but taken up subsequently by FRIES in another part of his Systema shall be typified on the types and description given by the original author, disregarding the newer circumscriptions and types given by FRIES.

[This gives a definite guidance on a point where there is much confusion. In addition it safeguards the species and genera of PERSON and other authors who published between the 1821-32 more accurate descriptions and figures than those given by FRIES. cf. also Discussions 19-21].

**ART. 51A: NOTE 5:** If in instating a new name there was cited an equivalent priorable synonym of which the new name may be taken as a new combination under Arts. 53A bis and 56A bis, then the new name shall be taken as the isonym of the cited synonym and typified accordingly, even though the instatement was accompanied by a new description and by an indication of a new holotype. If two or more synonyms have equal claim to be the basynym and no clue has been given by the author to discriminate between the rival claims, then the earliest of the synonyms shall be taken as the basynym. If the cited synonym was impriorable, the new name shall be typified (that is, when no holotype

has been indicated) on any of the syntypes; the lectotype thus chosen may or may not be the type of the cited synonym.

**Example 1:** In Example (d) under Art. 56A (1939), *Petunia minima* Reiche (1910) is a priorable isonym of *Nicotiana minima* Phil. (1864), non Molina (1782). Hence *Combera minima* Sandw. (1939) must be taken as a new combination of *P. minima* Reiche (1910), though SANDWITH regarded the former as a new name and had indicated a new type.

**Example 2:** *Cratoxylon formosum* Dyer (Fl. Brit. Ind. I, 1874, p. 258) was instated by a new description accompanied by the citation of two synonyms: *Elodea formosa* Jack (1822) and *Tridesmis formosa* Korth. (1839). These synonyms are not typonymous, and DYER did not indicate which of these two should be taken as the basynym of his name. Hence *E. formosa*, being earlier of the two, must be taken as the basynym of *C. formosum* Dyer, and the latter must be typified accordingly.

**Example 3:** Under *Ixora affinis* Don var. *arguta* Craib comb. nov. (1934) no descriptions was given, but the two following synonyms were cited: *I. arguta* King (1904) and *I. nigricans* Wight et Arn. var. *arguta* Hk. (1880). Since no varietal description can validate a species, or a variety outside its own species, and since a specific description can validate a variety (Art. 37A bis-4d), it is obvious that CRAIB's variety must be typified on the type of *I. arguta* King, and not on the variety cited in the synonyms. (See also the example in Note 8 below.)

**ART. 51A: NOTE 6:** If a new combination has been based on a priorable synonym of equal rank against the priority rule (Art. 56A bis), this new combination shall still be typified on its basynym [Discussion 15-16].

**Example 1:** *Shorea costata* Presl., Rostlinei II (1825) 66 was published by citing *Pterigium costatum* Correa (1806) and *Dryobalanops aromatica* Gaert. f. (1805). Though *D. aromatica* Gaertn. f. was older and priorable, and PRESLEM had violated the rule of priority, *S. costata* Presl. must be typified on *P. costatum* Correa. Under *Shorea*, *S. costata* (Correa) Presl. must be used whenever the synonyms are regarded as taxonomically different. [Symington states that the two synonyms are taxonomically different: Gard. Bull. Straits Settl. X (1939) 368-369 in Observ. sub *Shorea submontana*].

**ART. 51A: NOTE 7:** If a synonym that appears like a basynym is merely an expression to denote its misapplication, then the new name shall be typified on the new description and its syntypes; if no such new description was made available under the new name, the question of typification does not arise, since the new name is invalid (Art. 37A bis. Note 4-f).

**Example 1:** See the discussion of *Goniophlebium* Presl. in Note 3, Example 3.

**Example 2:** *Heleocharis capitata* R. Br. (1810) was based on a new description and citation of a misapplication of *Scirpus capitatus* L. *sensu* Willd., with a clear indication that the types of the latter species were excluded. Hence the species must be typified on the description and the syntypes given by R. BROWN, and not on the types of *Scirpus capitatus* L. [Much confusion has been caused by typifying *H. capitata* R. Br. on *S. capitatus* L. For fuller details see Furtado in Gard. Bull. Straits Settl. IX, 1937, pp. 293-294].

**ART. 51A: NOTE 8:** If a name is intended to be a new combination based on a synonym not admissible under Art. 37A bis, the name shall be typified on the new description and its syntypes; if no such new description was given under the name, the question of typification does not arise, since the name cannot be valid.

**Example 1:** *Ixora arguta* King in Journ. Asiat. Soc. Bengal LXXII (1904) 74 was instated by a description, accompanied by a citation, in the synonyms, of *L. nigricans* R. Br. var. *arguta* Hk. f. (1889). Since under Art. 37A bis-4(d), a varietal description cannot be cited to establish a species, *I. arguta* King must be typified on the types indicated by KING, and not by HOOKER.

[In Gard. Bull. Straits Settl. IX (1937) 294-296, I gave a different typification, since the Rules admit references to a varietal description in validating a species. Amendments have now been proposed to prohibit this procedure, as it causes serious complications in plant taxonomy and nomenclature. See Discussions 8, 13 and 14].

**Example 2:** *Hoya esculenta* (Rumphius) Tsiang comb. nov. in Sunyatsenia III (1936) 176 was instated by citing *Sussuela esculenta* Rumph. Herb. Amb. V (1747) 467 t/175 f. 2 (an invalid name with non-validable description—see Art. 20A), *Hoya diversifolia* Bl. (1826) and *H. orbiculata* Wight (1832), the last two being priorable synonyms. The epithet in the invalid synonym has been used in the mistaken belief that it had the right to priority; but since its description cannot validate *H. esculenta*, this new binomial must be regarded as invalid. (cf. Example in Note 9).

**ART. 51A: NOTE 9:** If a new name (nomen novum) has been instated by citation of a valid synonym, and by a new description, and no holotype has been indicated, all the syntypes of the description shall be included in the typification of the new name. If no new description was given, then the isonym shall be typified on the basonym.

**Example 1:** *Anodendron manubriatum* (Wall.) Merr. comb. nov. in Philipp. Journ. Sci. VII (1912) 333 was created by citing the following synonyms:

*Echites manubriata* Wall. Cat. (1829) n. 1663 (a nomen nudum).

*E. paniculata* Roxb. (1832) (a later homonym of *E. paniculata* Poir.).

*E. coriacea* Wall. Cat. n. 4464 (a misinterpretation of *E. coriacea* Bl.).

*A. paniculata* (Roxb.) DC. (1884) (a priorable name). No new description was given. The epithet *manubriata* was adopted for the new name on the mistaken belief that *A. paniculata* DC. was impriorable and that the Wallichian combination supplied the earliest epithet "that is tenable, although originally a *nomen nudum*." Since MERRILL intended *A. manubriatum* to be a new name for *A. paniculata* (Roxb.) DC., which he considered mistakenly to be impriorable, MERRILL's new name should be valid with reference to the description of *A. paniculata*. (*E. manubriata* was clearly recognized as a *nomen nudum* unable to validate the new combination. WALLICH had intended it to be a new name for *E. paniculata* Roxb., but unfortunately the publication of the latter was delayed and rendered the former name invalid).

**ART. 51A: NOTE 10:** If a specific name has been instated as a "new combination" with the generic name of the basynym as the specific epithet in the combination, the new name, though unsatisfactory under the priority rule, shall be typified on the basynym, disregarding the new description and new types.

**Examples:** *Artocarpus polyphemia* Pers. (1807) was based on *Polyphemia Champeden* Lour. (1790) and a description; the former, which was a legitimate isonym under the old custom, must be typified on the type of the latter (basynym). (It should not be possible to typify this isonym differently so as to permit its being considered not synonymous with *Artocarpus Champeden*).

**ART. 52: DELETE.** Incorporated with Art. 51A.

**SECTION 9A bis: REVISE** "Dates, Priorability and Legitimacy of Names".

**ART. 52B: TRANSFER** here Art. 61B Note 2; and **ADD:**

**NOTE 1:** All valid names of the necessary groups of the same rank must be included in priority considerations, subject to the Notes below and to Arts. 52D-F.

**NOTE 2:** Conserved names or nomina praecedenda take precedence over all other names for the groups for which they are conserved, even when they are later homonyms or later synonyms, provided the conservation is made explicitly for the purpose (Arts. 21B-D).

**NOTE 3:** When the starting point of nomenclature for a group of plants is a book issued in parts at different dates, and when, in the intervening periods, names have been validly published in another book, or periodical, these latter names, unless taken up in the starting point book, shall yield their precedence both in priorability and homonymy to the names published in the book fixed as the starting point. [cf. also Art. 51A Note 4].

**NOTE 4:** Specific epithets instated under a valid but impriorable genus are priorable in the same way as those established under a priorable genus. [Discussions 23 and 24].

**NOTE 5:** The priorability of the names of Fungi with pleomorphic life-cycle is guided by Art. 57 which prescribes that only the names given to the perfect state are to be admitted in priority considerations, the generic name including at least one specific name for a perfect form being also eligible for inclusion in priority considerations. The names of other states are only of temporary value, and cannot claim priority over the names of perfect groups.

**NOTE 6:** The priorability of the names of *subdivisionary* and *disjunctive* groups is restricted as follows:—

(a) Priorability of names or epithets denoting varieties and infra-varietal groups shall be restricted within their immediately superior group. When however a specific or subspecific name has become the basynym of a new name for the group, names of the subordinate groups under the basynym shall have priority claim under the isonym also, and conversely the names of the subordinate groups under the isonym shall claim priority right under the basynym. [Discussions 4–10].

(b) The priorability of the epithets of groups of the *subdivisionary* class shall be restricted within the same *necessary* group and under the same name, and this also when the basis of the classification is the same. If the name of the necessary group is the basynym or isonym of another name, then the subdivisionary epithets will have a priority claim under both the basynym and isonym of the necessary group, provided the basis of the classification is the same.

**Rec. XXXIIB:** Whenever a genus or its subdivision is transferred as a subdivision to another genus, botanists are advised, when possible, to retain, for the subdivision, the generic or subdivisional epithet, provided no priorable epithet is already available for it in the new position. [This is the old Art. 53].

**ART. 52C:** TRANSFER here Art. 45A and insert at the end of the first sentence, the second line, before the full-stop, “or in some cases from its earliest valid transfer (Note 1)”.

**NOTE 1:** The priorability of names and epithets of organisms transferred from the animal to the vegetable

kingdom, shall date from their earliest valid instatement in the vegetable kingdom. Mere citation of the names in the synonymy of botanical names shall not constitute a valid instatement under this rule.

[This is the natural consequence of Art. 36A bis; botanists should not be bound to refer to the works of zoologists, who are ruled by a different code of rules].

**ART. 52D: TRANSFER** here Art. 61A and Note 1, but **DELETE** Note 2 and "or its formal equivalent" in Art. 61A; and **ADD**:

**"NOTE 2: Later and simultaneous homonyms discarded under this rule are impriorable."**

[This Note 2 is Art. 61B. This amendment and those in Art. 61A (Art. 52D) are made in view of the proposed changes in Arts. 28A bis and in the limitation of priority in the names of non-necessary groups].

**NOTE 3: TRANSFER** here Art. 61B Note 1, after **OMITTING** "real (not formal)" from the first sentence.

**ART. 52E: TRANSFER** here Art. 62A, but **DELETE** "or legitimized".

**ART. 52F: TRANSFER** here Art. 63A, but **DELETE** the phrase "nor be legitimized", and substitute "not" for "neither".

**ART. 53A bis: READ** "adopted" for "legitimized" in the second paragraph, second line.

**NOTE 2: TRANSFER** here Art. 53B.

**SECTION 10: DELETE** the title. The Articles go with Section 9A bis.

**ART. 56A bis: READ** "adopt" and "adopted" for "legitimize" and "legitimized" respectively.

**SECTION 11 and ART. 58: DELETE.** [This confuses the rule of priority, which is applied to names of the same rank. This Article is also irrelevant. Art. 37A bis and 52B-C clarify the issue].

**Rec. XXXVIA: READ** "unless it becomes impriorable" for "unless it is rejected under Section 12". But **DELETE** Rec. XXXVI (3), as this confuses the typification. [Discussions 9, 13-14 and 25, and Art. 37A bis].

**SECTION 12 and ARTS. 59-69: DELETE.**

[Relevant matter has already been incorporated in Arts. 52B-F. These Articles are wrongly placed here, and much of the material is confusing. See Discussions 15 and 16].

**ART. 70A:** ADD to the first sentence in the second line before the full-stop "Or of a change made in the original spelling of the names and epithets in order to conform with the prescriptions and recommendations regarding gender, transcription, or termination".

**NOTE 4A: REVISE:** (a) Generic names of Greek origin differing merely by Greek and Latin terminations respectively, but involving no change in gender or other grammatical accident of words are orthographic variants or homonyms; where change in terminations indicates a difference in gender or other accident, the generic names must be considered as different (not homonymous).

(b) Orthographic variants may also be formed by a slight difference in spelling adopted for the sake of correct Latin form, correct etymology, or euphony in transliterating or transcribing a foreign word in Latin (without the change of gender or case), or by a decision of the Congress (Art. 21B). Different generic names made by slightly altering the spelling of the same word of foreign origin must be submitted for the decision of the Congress if they are likely to be confused as homonyms or orthographic variants.

(c) Specific and other epithets differing slightly in form and having the same meaning, or differing only in Greek and Latin terminations are considered as orthographic variants or homonyms, even when these terminations indicate a difference in gender or case, or sometimes in others accident also; the proper noun in any inflection and the adjectives derived from it are however different epithets e.g. (*Lysimachia Hemsleyana* and *L. Hemsleyi*).

(d) Changes made in the original spelling of specific and other epithets in order to conform with prescriptions and recommendations in regard to gender, transcription and termination do not constitute different epithets.

**Examples:** ADD (a) Different Generic Names: *Anodendron* and *Anadendron*; *Boea* and *Bouea*; *Gyrinops* and *Gyrinopsis*.

(b) Orthographic variants: Generic names: *Bulbophyllum* and *Bulbophyllon*; *Anadendron* and *Anadendrum*; *Dysoxylum* and *Dysoxylum*; *Eleocharis* and *Heleocharis*; *Bambos* and *Bambusa*; *Houmieri* and *Humiria*; *Swertia* and *Sweertia*; *Sesban* and *Sesbanea*; *Dictyosperma* and *Dictyospermum*.

(c) Orthographic variants and homonyms: (1) *Andreoskia* Reichb. apud Spach is a later homonym of *Andreoskia* DC. and an orthographic variant of *Andrzeiowskia* Reichb.;

(2) *Beureria* Spreng. is a later homonym of *Beureria* Ehret. and orthographic variant of *Bourreria* P. Br. and of *Beurreria* Spreng.; (3) *Schultzia* Spreng. a later homonym of *Schultzia* Rafin. and an orthographic variant of *Schultzia* Spreng.; (4) *Silvaea* Meissn. a later homonym of *Silvaea* Hook. et Arn. and an orthographic variant of *Silvia* Allem.; (5) *Wendtia* DC. an earlier homonym of *Wendtia* Meyen and an orthographic variant of *Wendia* Hoffm.; (6) *Dictyosperm* Wendl. et Dr. is a later homonym of *Dictyospermum* Wight and *Dytisperma* Raf. and an orthographic variant of *Dictyospermum* Wendl. et Dr.

(d) Orthographic variants: epithets: *integer-ra-grum*; *Kunstleri*, *Kunstlerii* and *Kuenstleri*; *sandwicensis-e* and *sandwichensis-e*. [Discussions 28 and 29].

**ART. 72B bis: SUBSTITUTE** "subordinate groups" for "subdivisions".

[This change is needed in order to conform with the restrictions made in the use of the term subdivision. Cf. Discussions 5-12].

## PALMAE MALESICAE—X

The Malayan species of *Salacca*.

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This genus of palms has usually been known by the name *Zalacca*, but in fact the earliest valid publication of the generic name is spelled *Salacca* by Reinwardt. The spelling *Zalacca* (copied from the Herbarium Amboinense) was adopted soon afterwards by Blume and has since been current. A discussion on the matter is given below under *S. edulis*. The genus belongs to the class *Lepidocaryeae*, so-called because the fruit in this class of palms has its outer coat made of small scales. In its structure, *Salacca* may be considered to represent a more primitive stage in the evolution of *Lepidocaryeae* than the species of *Calamus*, *Daemonorops* and allied genera.

The *Salaccas* are all apparently stemless or short-stemmed palms, usually tufted, producing very long leaves, (in one species small), bearing spines on leaf-stalks, and setae or spinules on the margins and sometimes on the veins of the leaflets. Each clump is produced by successive branchings near the base. The buds which produce the branches may begin growth in the axils of living leaves, or in the axils of leaves which have fallen. In the latter case, the branches are, so far as observed, always vegetative. In the former case, the developing bud pierces through the base of the leaf-sheath; and the branch may bear only a tuft of leaves, or only flowers, or it may bear both flowers and leaves. A branch which bears both flowers and leaves (the latter always terminal) may continue to produce flowers even after the leaves have begun to develop.

Each branch grows horizontally or obliquely upwards for a certain distance (this distance depending on the species) before producing its terminal erect tuft of leaves; the part below the leaves is covered with sheaths. The form of the whole clump is determined by the mode of growth and length of these branches.

The way in which the spadices arise in *Salacca* by puncturing the back of the leaf-sheath at its very base is markedly different from their origin in the allied Malayan genera, and especially from the species of *Calamus* and *Daemonorops* which have their spadices connate with the axillary internode and with the leaf-sheath above the

internode, so that a spadix in these latter two genera appears to arise externally from the sheath of the leaf above the axillant leaf.

Though the leaves of *Salacca* are very spiny, no claws or spines of any kind are found in any parts of the *Salacca* inflorescence, except on the outermost spathes of *S. conferta*. The fruits are always scaly, and sometimes the scales are pungent; and all such fruit scales may themselves be regarded as a transformation of spines. The spadix bears cylindrical spikes either directly on the main axis, or on primary, secondary, or tertiary branches. In some species these spikes are distant, in others they are close together; in a few species the spadices are as much as one to two metres long, whereas in some the spadix may be as short as 20 cm. Each spadix-branch arises in the axil of a spathe, but subsequent development may be such as to make the branch or spike appear much above the axillant spathe. A female spadix is somewhat dissimilar from the corresponding male spadix, and, though it is often shorter than the latter, it bears usually larger spikes. All the primary spathes are more or less coriaceous, loose, tubular at first, later open on one side to a greater part of their length, and in some species quite lacerate in the limb. The secondary and other spathes are similar but smaller, tending to be less firm, or almost chartaceous; sometimes there may be more than one spathe on the stalk that bears the spike.

The spike, which arises in the axil of a spathe, is composed of many approximate bracts (corresponding to the spathels of *Calamus*) which are more or less united at their margins. Within these bracts there are bracteoles which form an epicalyx to each flower.

The *male flowers* arise in a pair in the axil of each spathe (bract), each flower having a bracteole as the epicalyx. The calyx is membranous, 3-parted; the corolla is longer than the calyx, having a tubular base, fleshy at the very bottom, and a 3-partite limb. There are six epipetalous stamens; and the ovary is abortive.

The *female flowers* are either solitary in the axil of a bract (in *Leio-Salacca*), or each is accompanied by a neuter flower (*Eu-Salacca* and *Eleiodoxa*); but each female flower has an epicalyx formed of two bracteoles, while the epicalyx of the neuter flower, like that of the male flower, consists of only one bracteole. The calyx is membranous, 3-parted; the corolla nearly as long as, or slightly longer than, the calyx, valvately 3-partite; the staminodes six; the ovary 3-celled, strigose (*Eu-Salacca*), or not (*Leio-Salacca* and *Eleiodoxa*). The fruit is 1-3-celled, having either smooth adpressed scales (*Leio-Salacca* and *Eleiodoxa*), or specially

elongated sharp, upturned tips to the scales (*Eu-Salacca*). The seed is surrounded with a soft, somewhat acid edible integument; the endosperm is homogeneous with a deep cavity at its apex; the embryo is situated at the base, exactly opposite the apical cavity, or slightly above the base on one side.

In their general characters, the species of *Salacca* may be grouped into three classes as shewn in the previous paragraph; but the differences between these classes are such that systematists in general are not yet agreed whether the classes should receive the rank of sections, subgenera or genera; but considering that the species involved are not many, that the vegetative characters do not vary very much, and that the distinctions in the important reproductive parts are not clear-cut, I have found it expedient to keep these classes only as sections, and to adopt for them BECCARI's names, proposed originally both as sectional and as alternative subgeneric names.

### Distribution.

The genus *Salacca* is distributed throughout the Indo-Malaysian region from Assam, Burma, Siam, Indo-China, Malaya, Sumatra, Borneo, Java and the Philippines. A form with much edible flesh has been supposed to be native in Amboina, but RUMPHIUS is quite positive that this was introduced into Amboina from Bali and Banda Islands, and there is no other evidence of the genus occurring wild from Celebes eastwards.

### Nomenclature

Since *Zalacca* and *Salacca* are not two homonyms but different spellings of the same name (orthographic variants), combinations instated under the erroneously spelt generic name should be considered as having been instated also under the correctly spelt generic one; and on this view I have considered all the specific names originally published under *Zalacca* as validly published also under *Salacca*. To consider all those binomials which have been corrected here for the first time as to the spelling of the generic name as new combinations formed by me would be misleading.

[MILNE-REDHEAD (Kew Bull., 1948, p. 170) has considered *Fernandia Ferdinandii* (Welw.) Schum. (1903) and *Fernandoa Ferdinandii* (Welw.) Milne-Redhead (1948) as two different combinations, when *Fernandia* and *Fernandoa* are two different spellings of the same name; but such a procedure, in my opinion, is incorrect. Were *Fernandoa* a different name from *Fernandia*, then it would

not be possible to replace the earlier name *Fernandia* by a later name, *Fernandoa*, unless it were formally proposed for conservation; the replacement has been justified on the plea that the two names were orthographic variants and that the earlier was a wrong spelling of the later].

In the treatment given below, therefore, I have retained the name of the original author who made the binomial combination under the wrongly spelt generic name, though I have corrected the generic spelling. However, I have inserted Z or *Zalacca* in brackets after *Salacca* in order to show that the original combination was made under *Zalacca*.

Apart from this difference in spelling, there has been a good deal of confusion in the use of specific names established early in the genus. This is due mainly to the desire of later botanists to identify the "lost plants" described by 17th century writers. Hence, when establishing the genus or its species, these botanists sometimes quoted the pre-1753 writers who had described or depicted plants believed to belong to the species the later botanists were studying. But in fact the genus and its species were established by these later botanists, not by 17th century authors, so that in interpreting the genus or species, more importance should be attached to the specimens studied by the authors than to the doubtful figures quoted by them. Thus *S. edulis* was established on definite specimens studied by REINWARDT, on which the generic description was also based. This type material, a drawing of which was later made available to MARTIUS, should not be over-looked merely because REINWARDT had referred also to the previous writers who had described *Salacca* fruits imported to Europe preserved in brine, and to RUMPHIUS who, in addition to making a reference to these early descriptions, had figured and described some new plants under the name *Zalacca* (a latinised name used by BURMANN for the Rumphian *Zalack*). REINWARDT's material was from Java, where he had studied these plants in the living state; it is specifically identical with what MARTIUS later named *S. Blumeana*, apparently because the older specific epithet was misleading, for the fruits of all *Salaccas* known to him were edible. Typified on REINWARDT's specimen, *S. edulis* Reinw. becomes the correct name for *S. Blumeana* Mart. The Amboinese material depicted by RUMPHIUS is probably identical with *S. sumatrana*, a species which appears to be widespread in cultivation and to have many forms. The fruits, preserved in brine, that arrived in the 17th century in Europe may have been either *S. sumatrana*

or *S. edulis*, the latter having also more than one form in cultivation. Evidence is available to show that *S. Rumphii* is a binomial actually published by WALLICH with a plate for what has hitherto been known as *S. Wallichiana* Mart. Later in the text of the same book, WALLICH changed the name to *S. edulis*, apparently on the authority of MARTIUS, who at the time probably thought that all *Salaccas* represented one species only. But the earlier name is valid and so has the priority claim; this view was also defended by BLUME (*Rumphia* II, 1843, p. 158, sub. Observ.).

### Summary

Of the 13 species of the genus, the following are wild in the Malay Peninsula: *S. affinis*, *S. conferta*, *S. flabellata*, *S. glabrescens*, *S. Rumphii* and *S. Scortechinii*. RIDLEY does not include the last mentioned species in his *Flora* (1925), nor does he give any reason for this omission. Beccari's plate of the type of *S. Scortechinii* looks like a mixture consisting of a young leaf of *S. affinis* and a spadix of *S. conferta*, but I do not feel justified in making this reduction without being able to compare the original material with recent collections.

*Salacca conferta* is split into two species by BURRET (1942), under the genus *Eleiodoxa*, as *E. conferta* and *E. orthoschista*, the latter based on material collected in Singapore. Though we have very good material from Singapore, we have very little from Malacca, the type locality of *S. conferta*; on the evidence at present available, I am not able to separate the two species.

*S. flabellata* is the only new species described here; it is reported to be very common in two places in Kemaman (at Sungei Nipah and at Bukit Kajang). It is the smallest species in the genus and is easily recognized by its undivided leaves, a character not found in any other *Salacca* except in seedling stages. The species is known from male specimens only.

In the key to the species, the non-Malayan species *S. sumatrana*, *S. vermicularis* and *S. edulis*, are given in order to make clear the identity of *S. edulis*, which is found occasionally cultivated or as an escape in Malaya, and is probably the species commonly cultivated in Java for the export of its fruits. I have also given the synonyms of *S. edulis*, so that the use of the name is clarified. *S. borneensis* has been reduced to a variety of *S. affinis*, but the variety has not been recorded in Malaya.

## KEY TO THE SPECIES

Leaves not divided into separate leaflets, whitish beneath (Eu-SALACCA?)

1. *S. flabellata* Furtado.

Leaves pinnate, whitish beneath or not

Fruit clothed with scales having pungent tips (Eu-SALACCA)

Leaflets whitish beneath

Leaflets equidistant, at least in the upper half of the leaf

2. *S. sumatrana* Becc.

Leaflets inequidistant throughout, often in groups

Male spikes long, erect, spreading, entirely exsert from the spathes

3. *S. vermicularis* Becc.

Male spikes short, congested, nearly enclosed in the spathes

4. *S. edulis* Reinw.

Leaflets green on both surfaces, not whitish beneath

Leaflets distinctly sigmoid at base with smooth costae. Male spikes glabrous outside. Fruit globose or pyriform, suddenly beaked.

5. *S. glabrescens* Griff.

Leaflets oblanceolate, sometimes spinulose on midcosta above. Male spikes tomentose outside. Fruit obovate-pyriform, conically beaked at apex

6. *S. Rumphii* Wall.

Fruit smooth, not covered with pungent scales

Female flowers solitary (LEIO-SALACCA)

Fruit with scales arranged with 21-26 vertical series

7. *S. affinis* Griff.

Fruit with scales in 18-19 vertical series

8. *S. affinis* var. *borneensis* (Becc.) Furtado

Female flowers accompanied by a neuter flower (ELEIODOXA)

Leaflets straight

9. *S. conferta* Griff.

Leaflets sigmoid

10. *S. Scortechinii* Becc.

## The Species

### A. Section EU-SALACCA (Eu-Zalacca) Becc.

Female flowers each accompanied by a neuter flower; ovary strigose; fruit provided with scales with sharp, up-turned tips; seeds 3.

1. *Salacca edulis* Reinwardt in Syll. Ratisb. II (1825) 3; Hubbard et Rehder in Bot. Mus. Leaflets Harv. Univ. I (1932) 9.

*Zalacca edulis* Reinw. *apud* Bl. in Roem. et Schultes, Syst. Nat. VII (1830) 1334; Wall., Pl. Asiat. Rar. III (1832) 14; Bl., Rumphia II (1843?) 159; Miq., Fl. Ind. Bat. III (1855) 81; Kurz in Natuurk. Tijdschr. Nederl. Ind. XXVI (1864) 217; Becc. in Malesia II (1886) 64 et in Ann. Roy. Bot. Gard. Calc. XII, 3 (1918) 72 (omnino pro parte typica).

*Z. Blumeana* Mart., Hist. Nat. Palm. III (1838) 202 (1st ed.) t. 123 et t. 159 fig. 3. et 2nd. ed. (1849) 201; Becc. in Malesia III (1886) 55 et. in Ann. Roy. Bot. Gard. Calc. XII, 3 (1918) 77, t. 46.

BECCARI typified *S. edulis* on the belief that, being the first and only species published under the genus *Salacca*, it had to be typified entirely on the earliest reference given by RUMPHIUS and by REINWARDT. The Rumphian *Zalacca* seu *Rottan Zalak* (Herb. Amb. V, p. 113, t. 57, fig. 2) refers to plants found in Amboina, Bali and Java, though the plate is apparently of a plant cultivated in Amboina; but both the description and the figure are too poor for an accurate determination of the species. On BECCARI's own showing the Rumphian plate should be identified with what he calls *Z. edulis* var. *amboinensis* which, I believe, is a variety of *S. sumatrana* Becc. The earliest reference cited by RUMPHIUS and also by REINWARDT is CLUSIUS's Exot. Libr. II Cap. iv (1605) 266 (*Baly insulae fructus aspero cortice*) which is also cited by C. BAUHIN as *Fructus squamosus pyriformis* in Pin VI (1623) 511; CLUSIUS gives a drawing of a fruit that had reached Europe from Bali preserved in brine. This drawing is quite insufficient for a correct identification of the species.

On the other hand, REINWARDT, the author of the genus and the species, (*S. edulis*), was in Java and it is the Java plant that he had actually studied and named first *Salakka edulis* in Blume, Cat. Gew. Buitenz. (1823) 112 (cf. also p. 4 of this Catalogue for reference to REINWARDT's manuscript work on Java plants), and then in the latinised form quoted above. I have not been able to consult REINWARDT's actual protologue of the species and of the

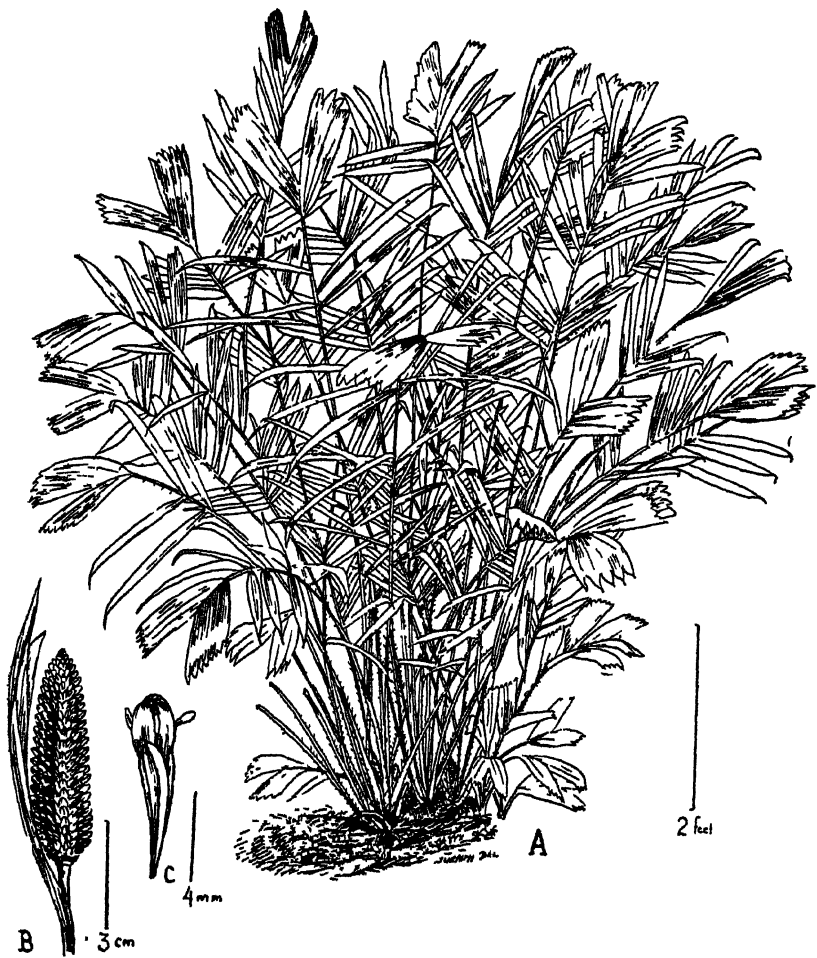


Fig. 1. *S. edulis*, ♂. (in Hort. Bot. Sing. culta).

A. Speciei habitus. B. Spica cum spathe. C. Flos masculus.

genus. But the fact that REINWARDT had studied Javanese material in establishing *Salacca* and *S. edulis* should not be overlooked, on the plea that the generic name had been used in pre-1753 books for a different species (a species not easy to be established from the available data). REINWARDT obviously established his species and the genus on the specimens actually studied by him (fruit figured by Martius in t. 159, fig. 3), but consistent with contemporary ideas and to throw light on the previous history of the plants in European literature, he also referred to previous descriptions and drawings of plants which appeared to him identical with his specimens; but this did not mean that, in case these anciently described plants proved different specifically or generically, we should discard Reinwardt's original studies made on clear specimens and typify the species on what he himself could not study satisfactorily. Also under Art. 42 (2) of the Rules we are obliged to consider that REINWARDT established his new genus *Salacca* with reference to his new description based on the living material, not with reference to its previous description given under the same name. This means therefore that we have to identify *S. edulis* with REINWARDT's Javanese material, a drawing of which was published by MARTIUS under *S. Blumeana*.

Thus typified, *S. edulis* Reinw. becomes synonymous with *S. Blumeana* Mart., and it was thus interpreted by MARTIUS (1838) and BLUME (1843?). The probable reason why MARTIUS replaced the specific epithet *edulis* by *Blumeana* is that there were more than one species having edible fruits and many of his contemporaries would employ the epithet wrongly to name any species having an edible fruit; besides, previous to the creation of the new name *S. Blumeana*, WALLICH (1832) had adopted *S. edulis* for *S. Rumphii*. But such considerations are not valid now; and it appears that they were not valid among many contemporary botanists of MARTIUS himself, for BLUME (1843, p. 158 sub-Observatio) states that under "jus prioritatis" *S. edulis* should be the correct name for what MARTIUS had called *S. Blumeana*.

Fortunately this typification of *S. edulis* does not leave the Amboinese material without a name, for I believe it is identical with *S. sumatrana*, which includes three forms or varieties: one with all leaflets equidistant, the second with leaflets subequidistant or obscurely so towards the base, and the third with leaflets distinctly grouped in the basal portion. In all these varieties the leaflets at the leaf-apex seem to be free, not united as in *S. edulis*. The shape of the fruit is not a good diagnostic character in *Salacca*, as it is determined by

the amount of free space the fruits have for their development; if many of the fruits drop off when young or fail to develop, the remaining fruits have more space and then often have a rounded base, or a less cuneate base than fruits growing closely together.

From the data given of plantings in the Botanic Gardens, Buitenzorg, *S. sumatrana* is also cultivated (or wild?) in Java and Borneo, and probably we have to locate the original home of this species in this region extending as far as Sumatra. *S. vermicularis*, which is closely allied to *S. sumatrana* and to *S. edulis*, is found wild in Borneo, reaching the Kinabalu Mountains at an altitude of about 1000–1500m.

## 2. *Salacca flabellata* Furtado sp. nov.

Ab omnibus hujus generis speciebus haec differt foliis parvissimis flabellatis apice bifidis, spadicebus flabelliformibus gracillimis, caule brevissimo cum vaginis ad 5 cm. in diam.

*Caulis* gracilis, brevissimus, in parte folioferente circa 7 cm. altus, cum vaginis ad 5 cm. in diam., in altera parte repens, subterraneus, brevis, plures radices gerens. *Frondes* flabellatae, dimensione variables, hic majores tantum designatae; petiolus 1.5–2 m. longus, 5–10 mm. in diam., trigonus vel subteres, basi longe canaliculatus et alis semi-coriaceis mox marcescentibus deciduis vaginatus, aculeis 5–25 mm. longis rigidis saepe porrectis irregulariter sitis, apicem versus paucioribus, minoribus secus dorsum tantum praeditis; flabellum subtile albescent, ambitu elongato obovatum, 80–100 cm. longum, apice latissimum, bifidum, 40–45 cm. latum, basin versus sensim angustatum, infimo oblique cuneatum, summo pinnis paulo sejunctis apice et secus margines liberas setosis, rachidi 50–60 cm. longa, basi tantum armata vel non. *Spadices masculi* 1–2 m. longi, axi 3–4 mm. in diam., funiculati, gracillimi, indivisi, in axilla frondis solitarii, basi petioli perforata orientes, spiculas 1.5–3 cm. longas, in spathae axilla primariae solitarias, longe pedicellatas, pedicello quam internodus paulo brevior, spathas secundarias, fere chartaceas ferentes; spathis primariis quam internodi 5–10 cm. longi longioribus, coriaceis, apice mox fibrosis; floribus masculis clavatis, circa 4 mm. longis; corolla quam calyx fere duplo longiore.

*Stem* smallest in the genus, with sheaths 5 cm. through, hardly above ground. *Leaves* similar, of varying dimensions, the largest as follows: petiole 1.5–2 m. long, 5–10 mm. in diam., trigonal in its basal half, almost terete in the

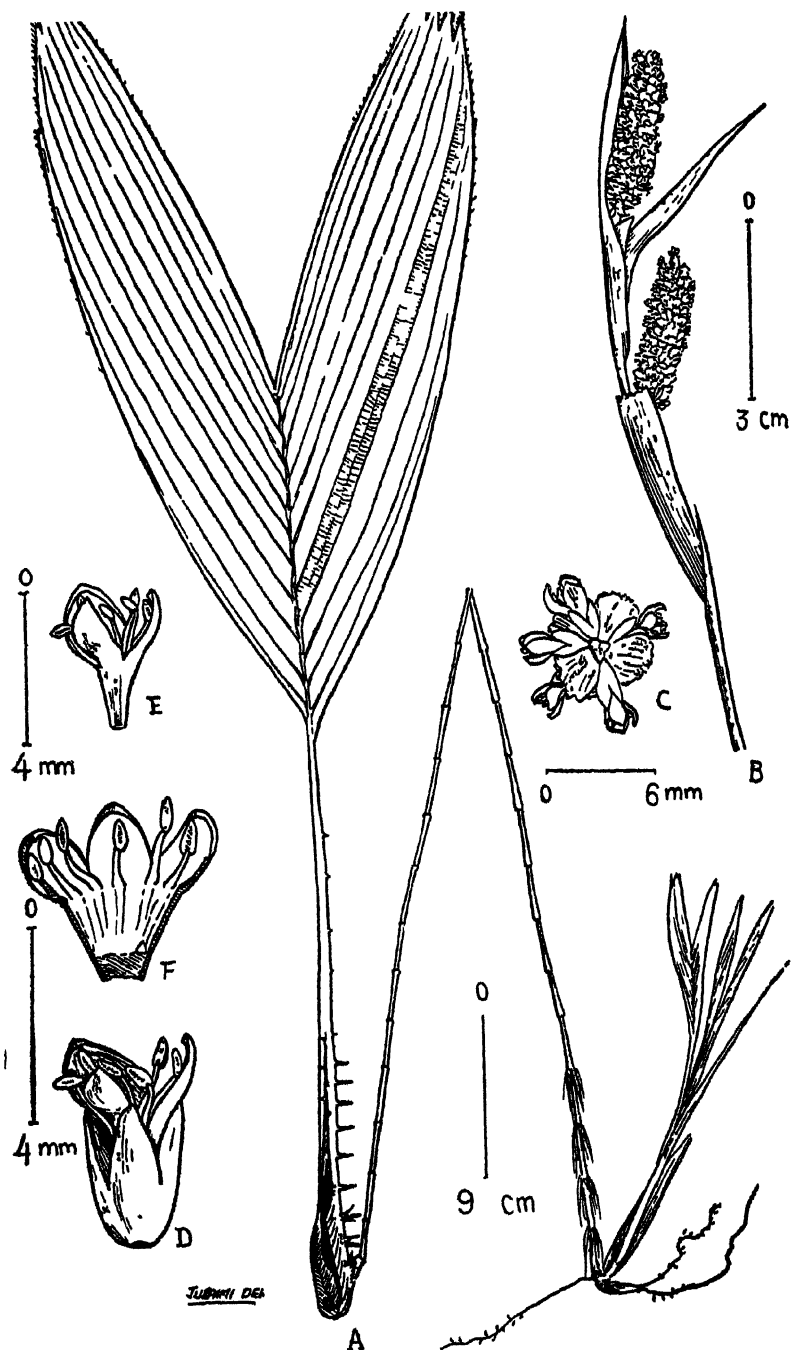


Fig. 2. *S. flabellata*, ♂. (Holotypus: Corner 30,525).

A. Frons, cum spadice apice foliis parvissimis praedito. B. Spadicis apex cum spathis spicisque. C. Sectio horizontalis ex spicae medio. D. Flos sub anthesi. E. Flos, sepala resecta. F. Corolla aperta cum staminibus.

upper; channelled and provided with deciduous, vaginal wings at base, armed irregularly with 5-25 mm. long rigid spines, which become fewer, smaller towards the apex (where they are dorsal only) and in the base of the leaf rachis; lamina flabellate, deeply bifid at apex, whitish beneath, obovate, 80-100 cm. long, 40-45 cm. wide at apex, gradually narrowed towards the base where it is obliquely cuneate; rachis 50-60 cm. long and armed or not at base; the lamina with a short free tip corresponding to each vein, setose along the margins and at apices. *Male spadix* emerging through a puncture in the dorsum of the petiole-base, whip-like, solitary, 1-2 m. long, 3-4 mm. in diam., with internodes 5-10 cm. long; primary spathes slightly longer than the internodes, tubular, soon split into a fibrous limb in the upper half; spike one in the axil of each spathe, 1.5-3 cm. long, 10-12 mm. through, provided with a pedicel slightly longer than the spadix-internode; secondary (empty) spathes on the pedicels, chartaceous; flowers male, clavate, 4 mm. long.

MALAYA: *Kemaman*, Sungei Nipah, on hillsides and in swamps by streams (Corner, 30,525, vern. nom. *Salak Chabang*).

Plants with much smaller leaves and spadices are also found in the same clump, which is formed of distant stems united together by whip-like branches or spadix-axes. However in the description given above measurements are those of the largest specimens seen in the collection.

The collector notes that this species is quite common also at Bukit Kajang, Kemaman, on the hillside near Ulu Ayam swamp. The spadices are reported to grow first upwards and then down or straight over the surface of the ground, sometimes burrowing under humus or becoming silted over in swampy places; the flowers are recorded to be produced on the spadix even after it has produced a young palmlet at the end. This phenomenon of producing a new stem at the end of a spadix is noticed also in *S. Rumphii*. Both this species and *S. flabellata* have long spadices which reach the ground, where a spadix will receive the necessary stimulus to produce shoots and roots; in other species such conditions are only possible when the stems are very young, and hence it has not been possible in these to observe the phenomenon of branching.

*S. flabellata* is the only species in the genus to produce leaves having their pinnae united even in adult stages; in other species the phenomenon may be noticed in seedling stages only.

3. *Salacca* (Z) *glabrescens* Griff. in Calc. Journ. Nat. Hist. V (1844) 14; Mart., Hist. Nat. Palm. III ed. 2 (1849) 202; Griff., Palms Brit. Ind. (1850) 17 t. 179; Becc. et Hook. f., Fl. Brit. Ind. VI (1893) 473; Curtis in Journ. Roy. Asiat. Soc. Str. Branch XXV (1891) 151; Ridl., Mat. Fl. Malayan Pen. II (1907) 170; Becc. in Ann. Roy. Bot. Gard. Calc. XII, 3 (1918) 86 tt. 52 et 53; Ridl., Fl. Malay Pen. V (1925) 33.

*Z. Blumeana* Mart. *sensu* Ridl., in Trans. Linn. Soc. III (1893) 392.

*Z. edulis* Reinw. *sensu* Becc. in Malesia III (1886) 64 partim.

*Stems* short, trailing or without any part visible above ground, tufted. Leaves very large, 1-5 m. long; petiole 1-1.25 m. long, deciduously rusty furfuraceous; spines 3-5 cm. long or shorter, confluent in oblique or horizontal rows, shorter and fewer in upper parts, and in the rachis of the leaf lamina. *Leaflets* in groups of 2-3, nearly equidistant in upper parts of the young leaves, 3-costate, sigmoid, concolorous, smooth on both surfaces, spinulous along the margins; the largest mesial, 30-35 cm. long, 5-6.5 cm. wide; lowest narrower, and the uppermost often united in a bilobed flabellum. *Male spadix* 25-40 cm. long, deciduously rusty furfuraceous in axis and spathes, diffusely divided into short branches; primary spathes 8-20 cm. long, shortly tubular at base, ventrally opened into a broad, boat-shaped, acuminate limb; spike cylindrical, 4-10 cm. long, stalked, produced on primary, secondary or tertiary branches, exerted fully from its own spathe, glabrous outside or very nearly so. *Female spadix* slightly shorter and less branched than the male; spikes 7-13 cm. long, 2-2.25 cm. wide, externally glabrous or very slightly squarrose; the female flower large, 8 mm. long, accompanied by a smaller neuter flower. *Fruit* pyriform, 4-5 cm. long, 3-4 cm. in diam., gradually narrowed towards the base, abruptly contracted into a beak 5-10 mm. long, or longer in young fruits, covered with scales having upturned points; seeds 2-3 (when two semi-oboval); embryo opposite to the apical pit, slightly above the basal point.

**MALAYA:** *Trengganu*, Ulu Brang, Tersat, alt. 1000 m. (Moysey and Kiah, 33,395). *Kemaman*, Ulu Kajang (Corner, 30,495). *Pahang*, Tahan (Ridley 3,141); Kuala Lipis (Machado sub Ridley num. 11,613); Gunong Senyum (Henderson, 22,224, as *Zalak Utan*); Pelangai or Manchis (Burkill and Haniff, 16,791, as *Buah Salak*). *Penang*, Balek Pulau, alt. circa 660 m. (Curtis in June 1890); Telok Bahang (Curtis's Collector, as *Choochae*); Government Hill

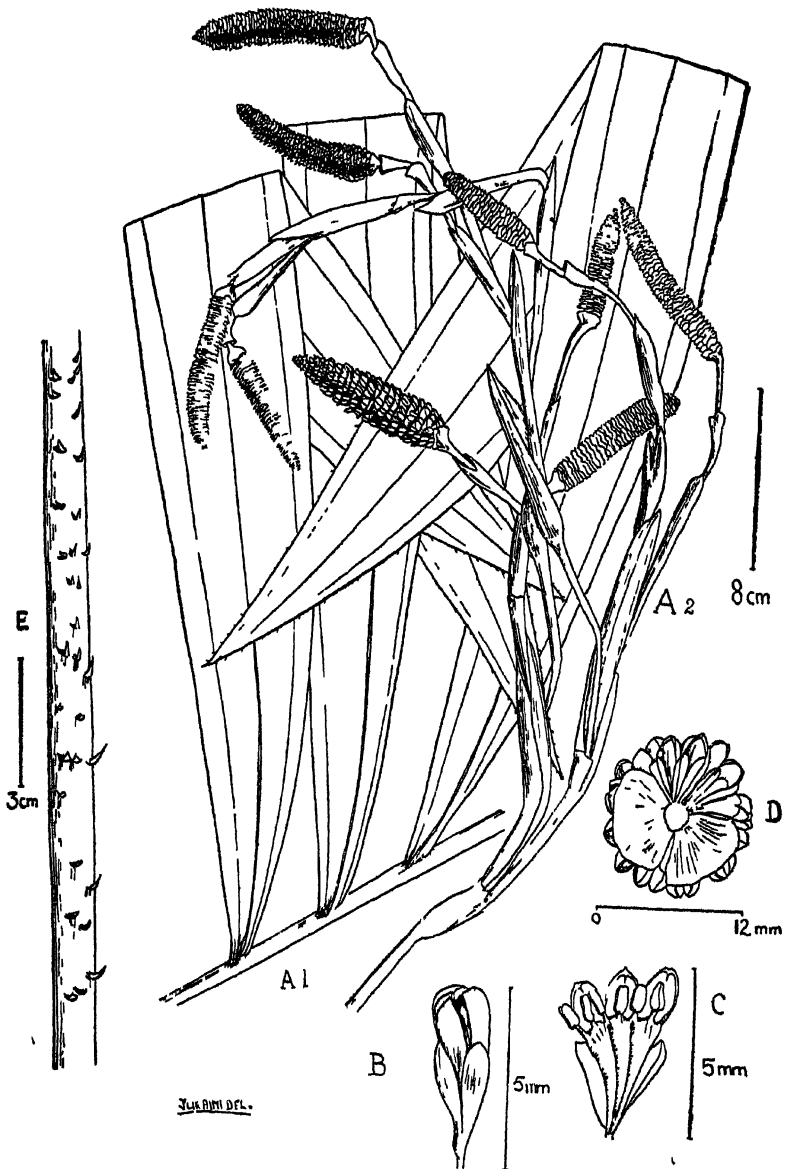


Fig. 3. *S. glabrescens*, ♂. (Nur 11,965).

A1. Frondis pars cum foliolis. A2. Spadicis pars. B. Alabastrum.  
C. Flos apertus ut staminum insertio appareat. D. Spicae sectio  
transversa. E. Petioli pars.

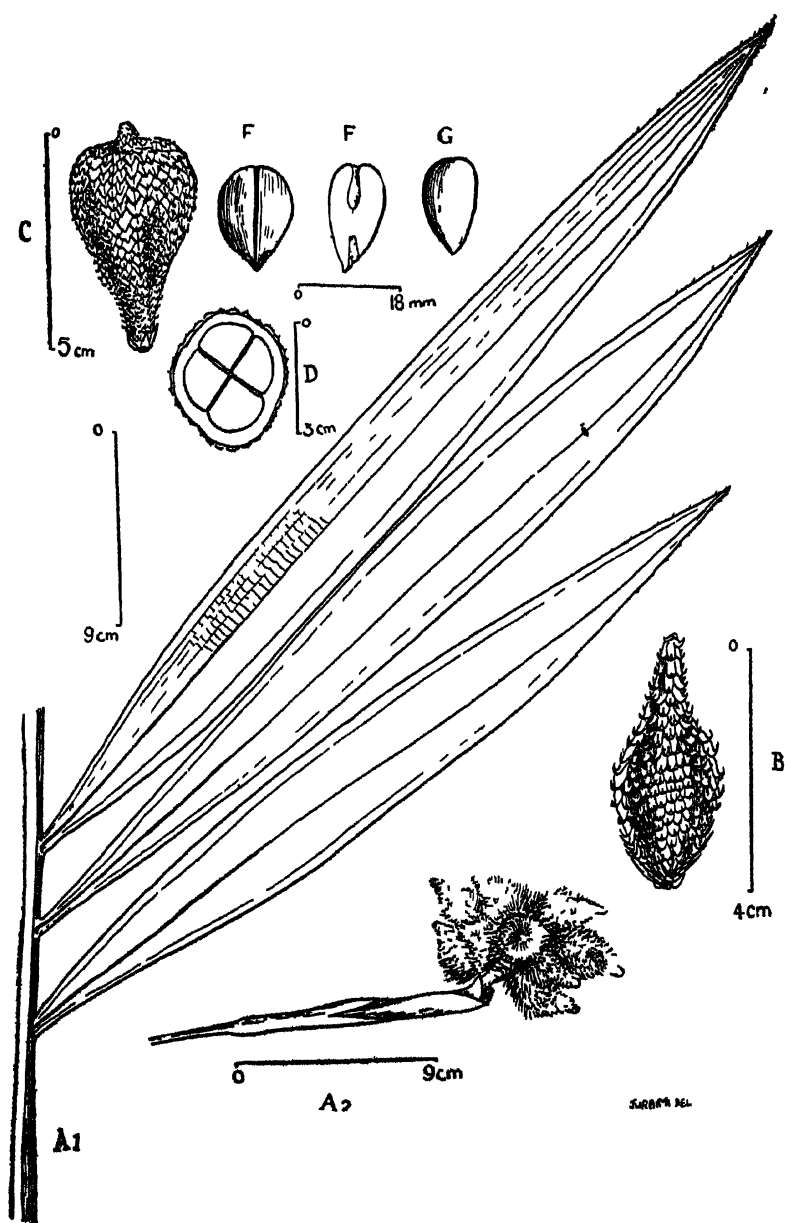


Fig. 4. *S. glabrescens*, ♀. (A and B: Curtis 2,435; C-G: Henderson 22,224).

A1. Pars rhacheos e basali frondis parte resecta, cum foliolis. A2. Ramus spadiceis fructiferus. B. Fructus immaturus. C. Fructus maturus. D. Sectio fructus transversa ut dispositio seminum 4 appareat. E. Semina dua ex fructu singulo. F. Semen verticaliter discissum. G. Semen integrum.

(Ridley in Feb. 1892); Penara Bukit, alt. circa 660 m. (Curtis 2,435); Moniot's Road (Curtis in April 1890). *Pciak*, Sungai Gepai, Bidur (Corner, 31,484 and 31,485); Bukit Chong, Kroh (Furtado, 33,017 as *Buah Kumbah*); Padang Chong, Kroh (Furtado, 33,006 as *Pokok Kumbah*). *Selangor*, Sempang (Ridley in Aug. 1909); Ulu Selangor (Goodenough in 1899); Kuala Lumpur (Ridley, 3,142 partim). *Singapore*, Garden Jungle, probably cultivated (Furtado 29,207).

This is easily distinguished by its sigmoid, grouped and concolorous leaflets, and by its spikes being externally glabrous or almost so, and also by its fruits being abruptly contracted into a long beak.

The shape of the fruits depends largely on whether they are congested or not; when congested, the fruits do not get space enough for the full development of the base and so become pyriform, gradually cuneate to the base. In young fruits, the beak is very long and gradually narrowed towards the apex; and it is therefore quite possible that the fruits, when given space, will develop at the base so as to become globose as described by HOOKER (Fl. Brit. Ind. VI, p. 474). Fruits with 4 seeds are also seen.

4. **Salacca (Z) Rumphii** Wall., Pl. Asiat. Rar. III (1832) tt. 222-3 and 224 and Index; Bl., Rumphia II (1843) 161.

*Z. Beccari* Hook. f., Fl. Brit. Ind. VI (1893) 474 quoad fructus.

*Z. edulis* Reinw. sensu Wall. op. cit. III (1832) 14 text; Griff., in Calc. Journ. Nat. Hist. V (1844) 8 et Palms Brit. Ind. (1850) 10, t. 175 (spadix only); Curtis in Journ. Roy. Asiat. Soc. Str. Branch XXV (1894) 151.

*Z. macrostachya* Griff. in Calc. Journ. Nat. Hist. V (1844) 13; Mart., Hist. Nat. Palm. III 2a. ed. (1849) 202; Griff., Palms Brit. Ind. (1850) 15, t. 178 A, B and C; Becc. in Malesia III (1886) 66.

*Z. Wallichiana* Mart., op. cit. III, ed. 1a (1838) 201, tt. 118, 119 et 136, et ed. 2a. (1849) 200, et (1850) 325; Kurz in Natuurk. Tijdschr. Ned. XXVII (1864) 214, et For. Fl. Brit. Burma II (1877) 511; Becc., Malesia III (1886) 66; Becc. et Hook. f., Fl. Brit. Ind. VI (1893) 473; Ridl., Mat. Fl. Malayan Pen. II (1907) 170; Becc. in Ann. Roy. Bot. Gard. Calc. XII, 3 (1918) 83, tt. 50, 50A, et 51; Ridl., Fl. Malay Pen, V (1925) 33; Blatter, Palms Brit. Ind. and Ceyl. (1925) 265, pl. 50.

*Stem* tufted, trailing or almost absent above ground. *Leaves* very large; petiole 1.50-2.50 m. long, armed with 4-8 cm. long spines arranged in oblique rows or rings; lamina

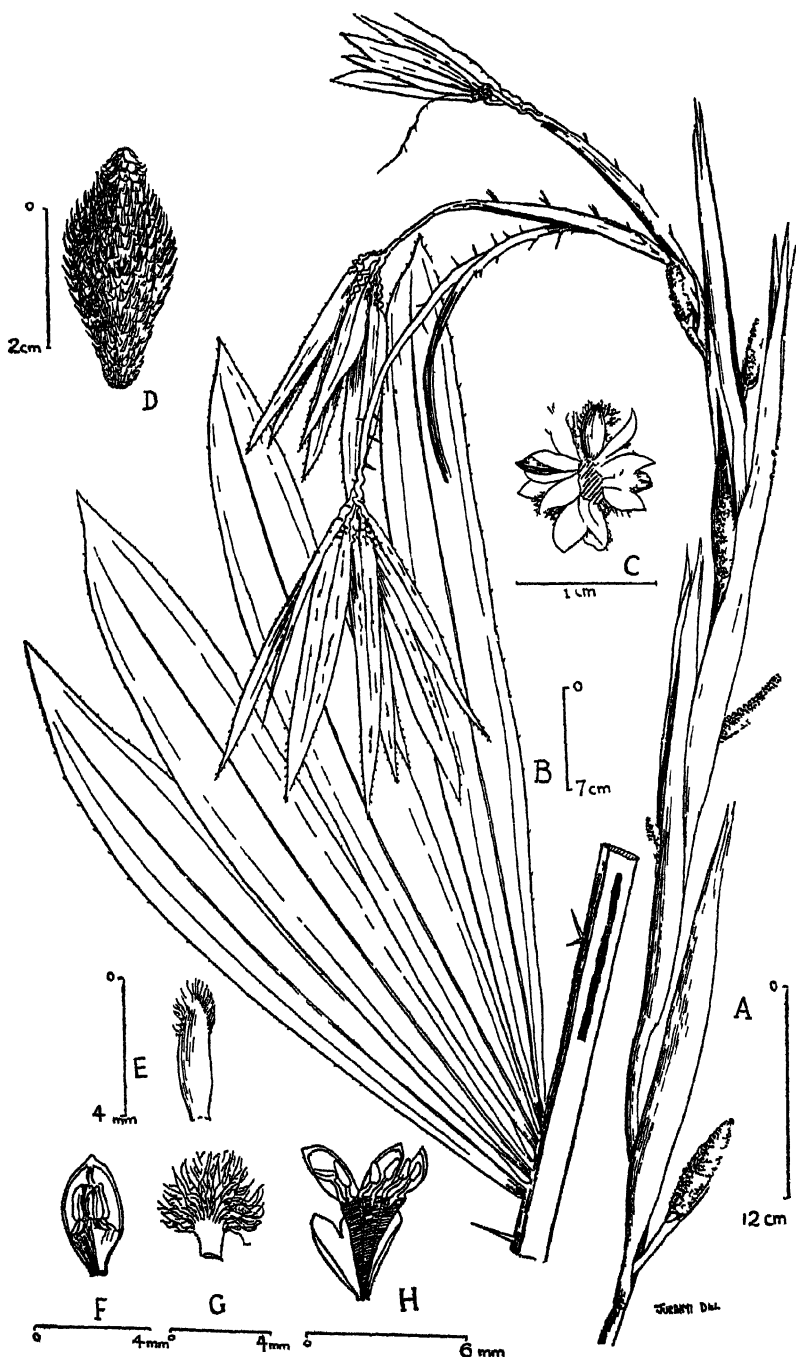


Fig. 5. *S. Rumphii*, ♂. (Furtado 33, 025; Fructus tantum: Furtado 33, 017).

- A. Spadix apice folia parvula ferens. B. Frondis pars. C. Sectio spicae transversa. D. Fructus immaturus. E. Spathella apice cum paleis barbae. F. Sectio alabastrum verticalis. G. Bracteola annulata. H. Flos apertus cum staminibus.

2.75–3.50 m. long, armed along the dorsum of the rachis with shorter spines which are approximate in the lower regions, solitary and distant in the upper. *Leaflets* in groups of 2–4 each, divergent, oblong-lanceolate, slightly falcate or sigmoidly so towards the apex, slightly paler beneath, abruptly acuminate, often ending in a filiform tip, smooth except occasionally for spinules above in the apical portion of the midcosta; margins setose; mesial leaflets largest, 60–80 cm. long, 7–9 cm. wide; apical leaflets shortest, basal narrowest. *Male spadix* deciduously rusty furfuraceous in axis and in spathes, 30–80 cm. long, divided into several secondary and tertiary pendulous spike-bearing branches; primary spathes lacerate longitudinally; spikes cylindrical, solitary, distant, shorter than the axillant spathe, covered with brown wool surrounding the male flowers. *Female spadix* larger than the male, similarly divided and covered with deciduous rusty furfur; the spike tomentose even externally; female flowers larger than the males, each accompanied by one neuter flower. *Fruit* obovate pyriform, or somewhat oblong, 7–8 cm. long, 4 cm. across, covered with light-coloured or fulvous scales; seeds 3, embryo basal being exactly opposite to the apical pit.

SIAM: cult. Hort. Bot. Bogor. (Furtado 31,148).

MALAYA: *Perlis*, Ginting Kabok (Ridley 15,362). *Pahang*, Tahan (Ridley 3,142 partim). *Perak*, Bukit Chong in Kroh (Furtado 33,017B); Ayer Panas in Kroh (Furtado 33,025). *Province Wellesley*, Permatang Bertam (Ridley 7,003); Bukit Juru (Ridley, sub. nom. vern. *Konibar*).

DISTRIBUTION: Burma and Sumatra.

The change in nomenclature above indicated is needed because there is evidence that WALLICH issued the plates and the Index to Pl. Asiat. Rar. III (1832) earlier than the text, so that even in the Index (to the plates), WALLICH retained the name *S. Rumphii* for his species. In the text, however, WALLICH changed the name to *S. edulis*, which he did apparently on the advice of MARTIUS (see also BLUME's manner of citing the synonym under *S. Rumphii*); and referred to the prior publication of the plate under the other name. BLUME's remark (op. cit. p. 158 in Observatio) that *S. Rumphii* Wall. has a "jus prioritatis" over *S. Wallichiana* Mart. corroborates this conclusion. GRIFFITH (op. cit. sub *Z. edulis*) and the editors of Index Kewensis also imply that *S. Rumphii* was published by WALLICH.

This species was based on male specimens from a Sumatran plant cultivated in the Botanic Gardens, Calcutta, and on female fruiting specimens collected by WALLICH in

Burma. The species is common in Malaya, though seldom collected. It has perhaps disappeared from some places like Penang and Singapore, where it was formerly reported to occur. The species is sometimes confused with *S. glabrescens* which has sigmoid leaflets and externally glabrous spikes. When CURTIS stated that *S. edulis* as described by GRIFFITH did not occur wild anywhere in the Malay Peninsula, it is obvious that he was speaking of the real *S. edulis*, and not of the plants described by GRIFFITH under that name.

The spadix of this species often produces a leafy sucker at its end.

#### B. Section LEIO-SALACCA (Leiozalacca) Becc.

Female flowers solitary; ovary smooth; fruit-scales without any pungent tips; seeds 1-3.

5. *Salacca* (Z) *affinis* Griff. in Calc. Journ. Nat. Hist. V (1844) 9 et Palms Brit. Ind. (1850) 12, t. 176 A, B and C; Mart., Hist. Nat. Palm. III (1849) 202, t. XXXI f. iv; Becc., Malesia III (1886) 67; Becc. et Hook. f., Fl. Brit. Ind. VI (1893) 169; Ridl., Mat. Fl. Malayan Pen. II (1907) 169 partim, et Fl. Malay Pen. V (1925) 32 partim.

*Stem* short, tufted, hardly above ground. *Leaves* 3-4 m. long; petiole armed with light-coloured, unequal, 3-6 cm. long, mostly approximate, deflected or ascendent spines which become gradually shorter and geminate or solitary on the rachis; lamina 1.75-2.50 m. long. *Leaflets* in one plane, in groups of 2-3 or 4 on each side of the rachis, oblanceolate-sigmoid with a slightly falcate point, often ending with a filiform apex, 3-costate, smooth on both surfaces, spinulose along the margins towards the apex; mesial leaflets 35-45 cm. long, 6-10 cm. wide; lower leaflets smaller, apical ones often united. *Male spadix* 50-100 cm. long, having short branches which bear spikes either solitary or in groups of 2 or more; spathes longer than the spikes, lanceolate, acuminate, more or less lacerate, thinly covered with a deciduous rusty furfur outside; spikes 4-6 cm. long, 8-12 mm. in diam., tomentose outside, bearing two male flowers at each spathe. *Female spadix* shorter, 30-50 cm. long, covered with a long split and lacerate spathe; branches shorter than the primary spathes, 5-10 cm. long; secondary spathes shorter but similar, bearing in their axils spikelets each up to 3 cm. long and bearing a few solitary female flowers; in the upper half of the spadix the spikelets are borne directly on the main axis. *Fruit* ovoid, sometimes

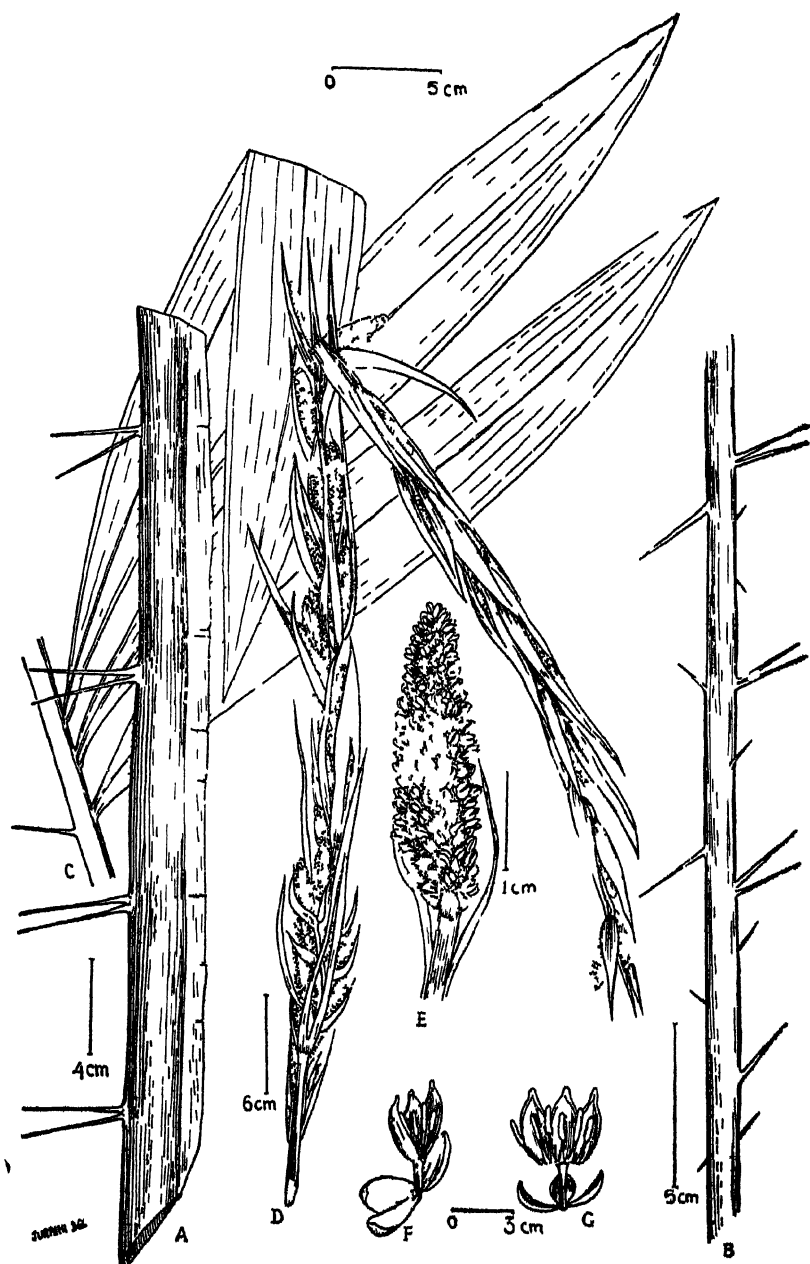


Fig. 6. *S. affinis*, ♂. (Furtado 31,149).

A. Petioli pars adulti. B. Petioli pars juvenilis. C. Frondis pars.  
D. Spadix. E. Spica cum spatha. F. Flos post anthesin. G. Flos  
apertus.

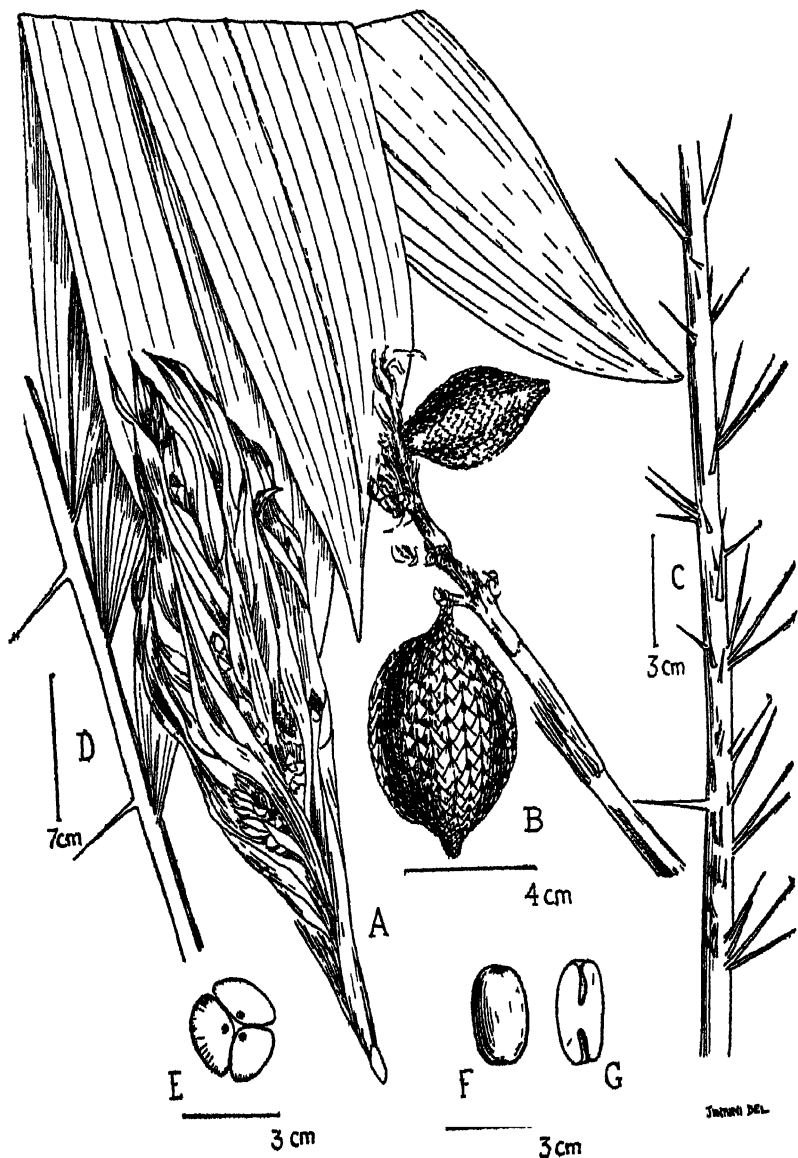


Fig. 7. *S. affinis*, ♀. (Furtado 33,058).

- A. Spadicis ramus. B. Ramulus spadicis cum fructibus maturis.  
 C. Petioli pars. D. Frondis pars cum foliolis. E. Semina tria  
 ut in pericarpii involucre disposita. F. Semen integrum.  
 G. Semen verticaliter discissum.

obovoid or irregular in shape, tapering both ways, mammillate at apex, covered with smooth scales disposed in 22–24 series (24–26 according to Beccari); seeds 3 or less, embryo basal exactly, opposite to the apical pit.

**MALAYA:** *Kedah*, Sungai Labong at Baling (Furtado 33,058 as *Buah Salak*); *Dindings*, Gunong Tungal (Ridley in II–1890). *Malacca*, Selendor (Alvins, 332 as *Pokok Ramgam*); Batu Tiga (Goodenough, 1,419 as *Salak Utan*). *Singapore*, Bukit Timah (Ridley in 1898); Chan Chu Kang (Ridley 4,421 partim, as *Salak Hutun*).

**SUMATRA:** cult. Hort. Bot. Bogor., probably Palembang (Furtado 31,149).

5-b. *Salacca affinis* var. *borneensis* Furtado stat. nov.

*Z. borneensis* Becc., Malesia III (1886) 68 et in Ann. Bot. Gard. Calc. XII, 3 (1918) 94, t. 59B.

A typica differt fructus squamis per series 18 dispositis.

This differs from the type in having the scales of the fruit disposed in 18 vertical series.

**BORNEO:** *Sarawak*, Kuching (Beccari).

So far known only from the type collection. There is a great deal of variation in the number of series of scales; all the Malayan fruits I examined show 22–24 series, whereas Beccari reports that in the Malayan specimens he examined there were 24–26 series.

C. Section ELEIODOXA Becc.

Female flowers each accompanied by a neuter flower; ovary smooth; fruit-scales without any pungent tips; seed 1.

6. *Salacca* (Z) *conferta* Griff. in Calc. Journ. Nat. Hist. V (1844) 16; Mart., Hist. Nat. Palm. III, ed. 2a (1849) 201, tt. 173 et 174; Griff., Palms Brit. Ind. (1850) 19, tt. 180 A, B and C; Becc. in Malesia III (1886) 67; Becc. et Hook. f. in Fl. Brit. Ind. VI (1893) 473; Ridl., Mat. Fl. Malayan Pen. II (1907) 169; Becc. in Ann. Roy. Bot. Gard. Calc. XII, 3 (1918) 95, t. 60; Ridl., Fl. Mal. Pen. V (1925) 32.

*Z. affinis* Griff. *sensu* Ridl. op. cit. II (1907) 169 et Fl. cit. V (1925) 32 partim.

*Eleiodoxa conferta* (Griff.). Burret in Notizbl. Bot. Gart. Berlin XV (1942) 734.

*E. orthoschista* Burret in Notizbl. cit. XV (1942) 735.

*Stem* tufted, short or hardly above ground. *Leaves* large, 5–6 m. long or more including 2.5–3 m. long deciduously rusty furfuraceous petiole; the latter covered with white-coloured black-tipped narrow spines 4–5 cm. long usually united at base into short oblique or transverse series; the spines on the dorsum of the rachis of the lamina shorter,

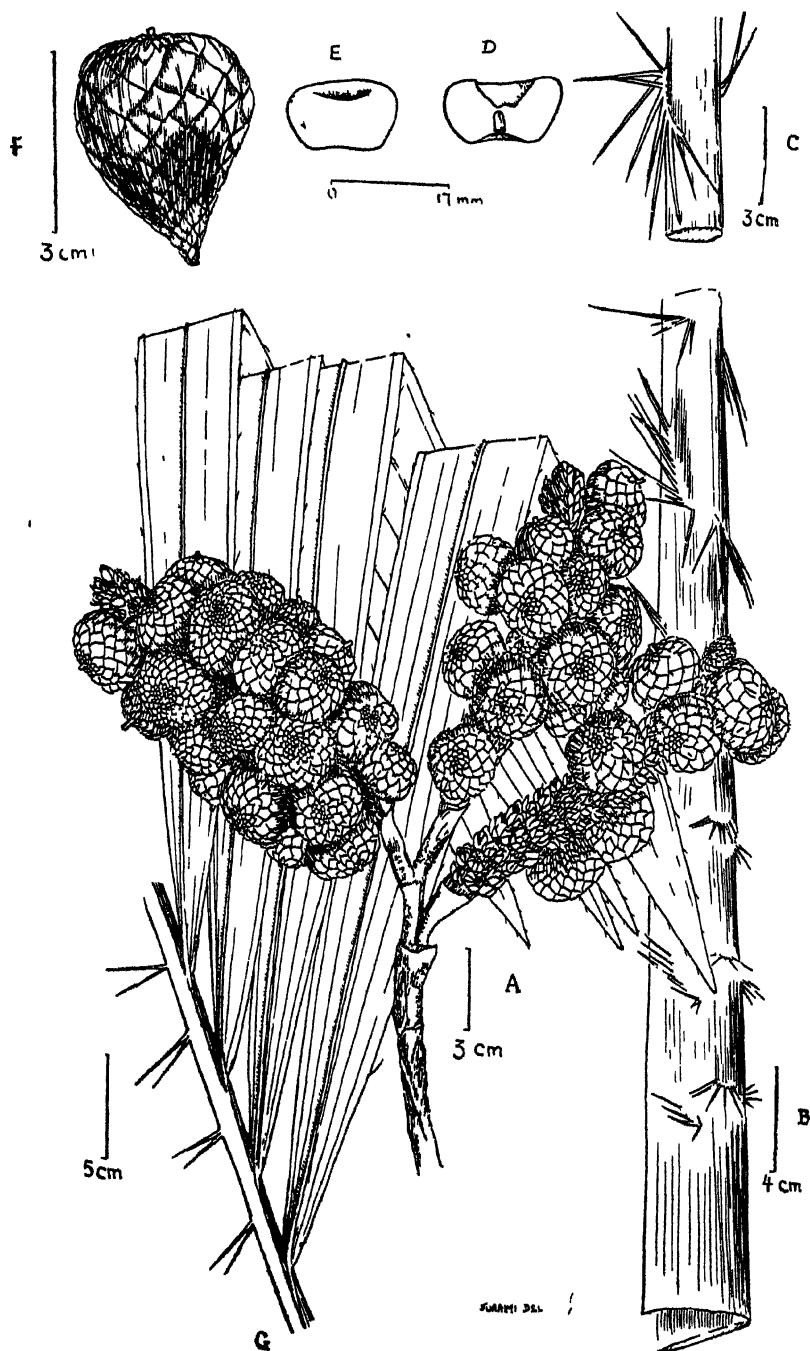


Fig. 8. *S. conferta*. (Furtado 37,923).

A. Spadicis ramus. B and C. Petioli particulae. D. Semen verticaliter discissum. E. Semen integrum. F. Fructus. G. Frondis pars cum foliolis.

often slenderer and fewer. *Leaflets* numerous, equidistant, alternate or subopposite, gradually narrowed nearly to a straight, slightly unequal base, almost ensiform, slightly unequal at apex, more or less spinulose in the costae above, smooth below, setose along the margins; the mesial largest, 50–70 cm. long, 4–5 cm. wide; the two terminal leaflets slightly connate at base and at times also laterally united with the next pair below. *Male spadix* erect, about 25–40 cm. long, congested, outermost spathe not seen; spikes borne on axis and on primary branches which are at times as long as the primary spikes or slightly longer, the basal spathes partly lacerate, gradually narrowed to an acuminate point; secondary spathes entire or very often so, shorter, frequently narrowed suddenly to an acuminate point; spikes bifarious, almost glabrous outside, almost equal except the terminal ones which are often smaller; male flowers in pairs at each spathe. *Female spadix* similar to male, but shorter, erect, congested to an oblong, ovoid mass, with very short primary, palmate branches, each branch being again divided into many smaller branchlets each bearing 1–2 or more spikes; outermost spathe 60 cm. long, tubular at base, with a long lanceolate acuminate limb, armed outside with long white black-tipped spines, deciduously rusty furfuraceous, soon lacerate, fibrous; secondary spathes lacerate and in fruiting spadix often fibrous; larger spikes 10–15 cm. long, about 2 cm. through; flowers usually a neuter and a female at each spathe, equal in size, but sometimes two female flowers without any acolyte neuter or with a neuter between the two female may be found. *Fruits* crowded, very irregular in shape but tending to become turbinate, convex or flat and shortly mucronate at apex, 4 cm. long, 2–3.5 cm. wide, with straw coloured smooth scales arranged in 21–24 series; seed solitary, surrounded with a fleshy integument, compressed longitudinally, two or three times as broad as high, nearly circular or reniform, 4–5 cm. high, 12–15 mm. broad (Beccari noticed one seed 10 mm. high, 22 mm. broad), with a broad shallow cavity at apex, and embryo at base.

MALAYA: *Kelantan*, Kota Bahru (collect. ignot.). *Dindings*, Lumut (Ridley in II-1892; Ridley and Curtis in III-1892). *Malacca*, loc. incert. (Alvins). *Johore*, Gunong Pulai (Best, 8,322 as *Asam Paya*). *Singapore*, Chan Chu Kang (Ridley 3,143 as *Asam Payah*; 3,502; 4,421 partim, as *Salak Hutan*; 4,622 as *Salak Hutan*); Jurong (Corner, 26,200: *isotype* of *E. orthoschista*; Furtado 37,923; Ngadiman 37,933 and 37,934).

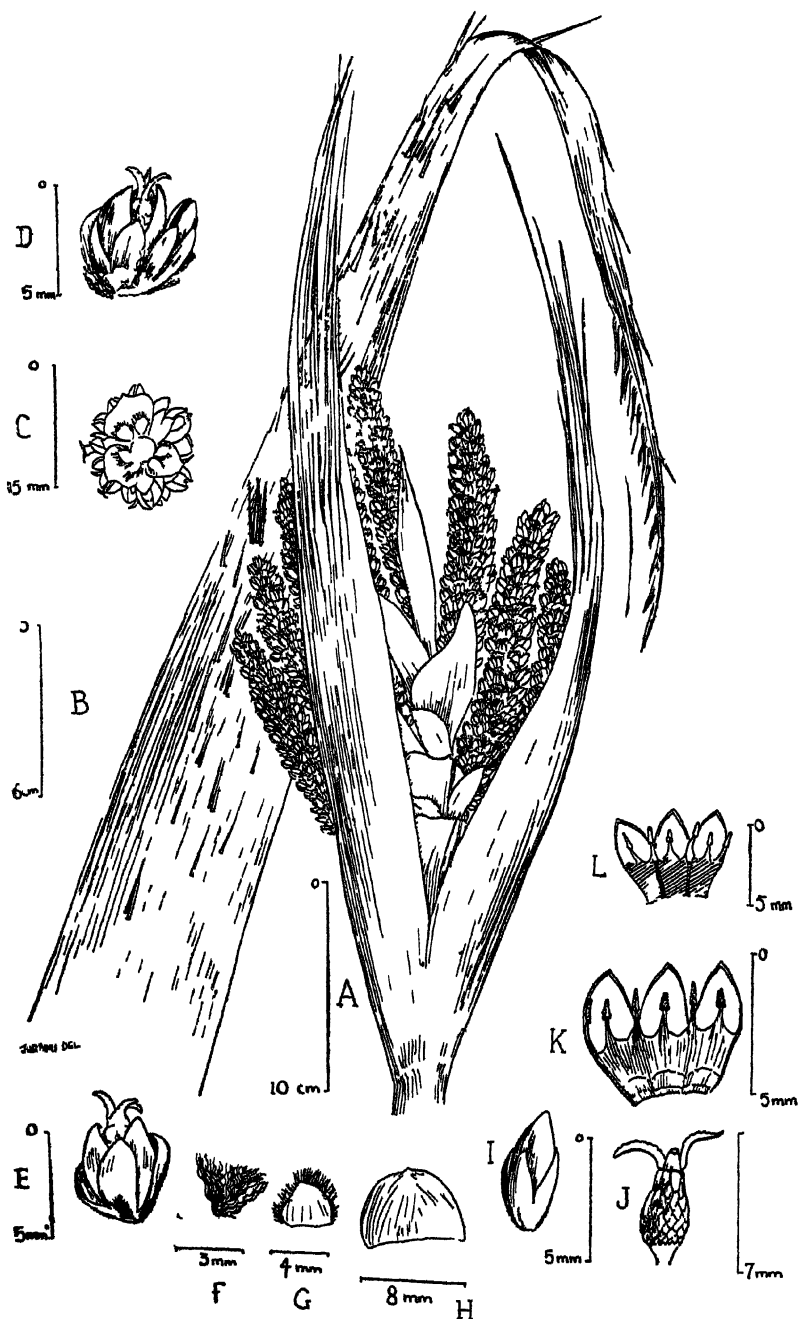


Fig 9 *S. conferta*. (Ngadman 37,933)

A Spadicis ramus B. Spatha prima, universalis D Flores (neuter femineusque) ut in axilla spathellae siti E. Flos femineus post anthesin. F-G Bracteolae H Spathella I Flos neuter J Ovarium K Corolla floris feminei aperta cum staminodis D. Floris corolla neutri aperta cum staminodis

BORNEO: *British North Borneo*, Jesselton at Lumot (Cuadra, A1,338, as *Asam Kolambi* in Brunei language).

DISTRIBUTION: Reported to occur also in Rhio and Bangka Islands.

There is a good deal of variation in this species as to size of its fruit as well as in the size and spinescence of the leaflets. BURRET has established *Eleiodoxa orthoschista* as distinct from *E. conferta* (*S. conferta*) but on the material available in Singapore, which lacks good specimens from Malacca (the type locality of *S. conferta*), I hesitate to admit his separation. *S. conferta* was apparently very widely spread in Singapore and its fruits were even sold in local bazaars by Malays (cf. Ridley in Journ. Roy. Asiat. Soc. Straits Settl. XXXIII, 1900, p. 176). RIDLEY has confused some material of this species with *S. affinis*.

7. *Salacca* (Z) *Scortechinii* Becc. in Ann. Roy. Bot. Gard. Calc. XII, 3 (1919) 97, t. 61.

*Stem* apparently similar in habit to *S. conferta*, but smaller. *Leaves* about 3-4 m. long including 1.5 m. petiole; spines few, distant, solitary, rarely united into lines or series, 10-15 mm. long on petiole becoming smaller and more distant on the rachis. *Leaflets* numerous, equidistant, distinctly sigmoid, 3-costate, smooth on both surfaces, spinulose along margin; mesial 45 cm. long, 3-3.5 cm. wide. *Female spadix* like that of *S. conferta*, but smaller, with shorter and narrower spikes. Fruit globose-turbinate, 2-2.5 cm. in diam.; seed discoid.

MALAYA: *Perak*, loc. incert. (*Scortechinii* as *Udang*).

This species is known only from the type collection, which perhaps is the reason why RIDLEY has ignored it. I have not seen the type and there is nothing in the Singapore herbarium which would match the plate given by BECCARI. It differs from *S. conferta* by its small, mostly solitary spines on the petiole and by its falcate-sigmoid leaflets. From the plate the species looks like a mixture consisting of a young leaf of *S. affinis* and a spadix of *S. conferta*; but without any comparative study, it is unsafe to make this reduction.

# WILLIAM FARQUHAR'S DRAWINGS OF MALACCA PLANTS

*By* I. H. BURKILL.

The Royal Asiatic Society of Great Britain and Ireland possesses a volume of paintings of plants, 55 in all, which was given to it in 1827 by Lieut.-Col. William Farquhar of the Engineers, the first Resident and Commandant of Singapore. In Farquhar's handwriting on the fly-leaf is written "Medicinal plants, etc., of Malacca" and his name. It is obvious that the paintings are part of the "very large collection of drawings and subjects of Natural History" which Jack said Farquhar had made in Malacca (see Jack's letters to Wallich (Jour. Straits Branch Roy. As. Soc. 73, p. 151; 1916)).

In 1818 Raffles was instructed by the Marquess of Hastings to seek a settlement to the eastward of Malacca, and, sailing from Calcutta in December with William Jack as his personal physician, reached Penang on the 31st; Farquhar who had been in Malacca since 1803, had been put under Raffles' orders and had arrived in Penang on the 30th bringing all or part of that collection with him. Jack in the letter cited wrote "I have just had an opportunity of examining his (Farquhar's) drawings of Malacca plants. Most unfortunately from want of scientific acquaintance with the subject they are deficient in many essential points of dissection; but they will be extremely useful as a guide by taking the native names . . . and making inquiries." Wallich says that Farquhar employed a Chinese artist. The pictures would be his work; and there is no reason to think that they are not all by one hand. Some of this artist's brush-work is very beautiful; some of his drawing is conventional and unreal; half of the pictures represent no more than the vegetative parts. Of course, Jack, now for the first time in Malaya, would feel it hopeless to put botanical names without flowers; and his criticism was just.

Under each picture (with seven exceptions) the Malay name is written in Arabic characters; one hand wrote the names under the first 25 pictures and numbered them; another wrote the names under the rest, but did not number them. Doubtless Farquhar used Malays on his staff for this; and there is none of his own handwriting anywhere; but it is clear that from somewhere there was a direction in the choice of subjects, because in the time of the first clerk Zingiberids were favoured: in the time of the second,

*Gardens Bulletin, S.*

esculent roots had some favour. Pencilled numbers are present also, and this numbering shows that two paintings that were numbered 9 and 47 were removed before the rest were bound. The volume was bound by a book-binder in Paternoster Row, London; and a numbering in ink at the tops of the pages appears to have been done at the time of binding: this numbering takes no notice of the missing two. After the binding had been done, someone transcribed the Malay names into English characters, first in pencil and then inked them; and the same hand added a few notes, the longest of which is on the use of *Croton* seeds among the Tamils. This hand sometimes introduced mistakes—for instance, wrote *rambaga* (for *rembega*) on the illustration of *Abutilon indicum* to which it does not belong, and, faced by a picture of the race of *Zingiber officinale* known as *halia padi*, though properly so named in Malay, wrote *aliea bara* which belongs to a different race.

Scattered on the pages are various attempted determinations, sometimes wild, in other hands, all assuredly written after the volume left Farquhar's possession. Disregarding them, I have made the following inventory by the numbers in ink:—

1. sērulai laut—*Wedelia biflora* DC.
2. kētuir—*Derris trifoliata* Lour. (*D. uliginosa* Benth.).
3. balek angin—*Mallotus paniculatus* Muell.-Arg.
4. balek adap—*Mussaenda*, probably *mutabilis* Hook. f.
5. lēnggundi—*Vitex trifolia* Linn., an unusual form with simple leaves.
6. hujan panas—*Phyllanthus pulcher* Wall.
7. tulang-tulang—probably one of the Rubiaceae.
8. gēndarusa—*Gendarussa vulgaris* Nees.
9. (without a name)—*Abutilon indicum* Don.
10. jēringau—*Acorus calamus* Linn.
11. tutup bumi—*Elephantopus scaber* Linn.
12. kēnchur—*Kamperia rotunda* Linn.
13. lēmpoyang wangi—*Zingiber aromaticum* Valetton.
14. lēnjuang—*Cordyline fruticosa* Goeppert.
15. bongēlai—*Zingiber cassumunar* Roxb.
16. aliya bara—*Zingiber officinale* Linn., a pungent race of ginger.
17. tēmu kunchi—*Gastrochilus panduratum* Ridl.
18. lēngkuas—*Languas galanga* Stuntz.
19. lēnguas ranting—*Languas melanococca* Burkill.
20. tēmu pauh—*Curcuma mangga* Valetton & van Zyp.
21. tēmu gajah—*Curcuma* probably *xanthorrhiza* Roxb.

22. haliya padi—*Zingiber officinale* Linn., a somewhat acrid race.
23. nara pusi—*Voandzeia subterranea* Thouars.
24. rumput kēmēnyan—*Salomonina* sp., agreeing with no known species.
25. ati-ati—*Coleus atropurpureus* Benth.
26. pokok jarak—*Ricinus communis* Linn., the Castor oil plant.
27. (without a name)—*Hibiscus sabdariffa* Linn., the Rozelle.
28. pokok sireh—*Piper betle* Linn., the Betel pepper plant.
29. tuba darat—*Derris trifoliata* Lour. as regards the fruit; but *D. heptaphylla* Merr. as regards the flowers.
30. rēmbeḡa—*Calotropis gigantea* R. Br.
31. don tumbōh duan—*Bryophyllum pinnatum* Kurz.
32. ubi tēropong—*Dioscorea esculenta* Burkill, the Lesser Yam.
33. kēledek puteh—*Ipomoea batatas* Lam., a rather curious race.
34. ubi Jawa—*Dioscorea alata* Linn., probably Roxburgh's *D. atropurpurea*.
35. (without a name)—an epiphytic orchid.
36. (without a name)—another epiphytic orchid.
37. ubi Bēnggala—*Manihot utilisissima* Pohl, the Tapioca plant.
38. pēnggaga—*Hydrocotyle asiatica* Linn.
39. kēladi puar—*Typhonium trilobatum* Schott.
40. chēmēkian—*Croton tiglium* Linn., the Croton oil plant.
41. kunyit—*Curcuma domestica* Valetton, the Turmeric plant.
42. kēladi sēmīnyak—*Colocasia esculenta* Schott, a pink skinned race.
43. kēladi bēlanda—the same, a pale brown skinned race.
44. kēladi Jawa—the same, a deep violet skinned race.
45. kēladi sērakoh bēnuwa—the same, with very numerous daughter tubers (probably the same race now known as kēladi rakit).
46. nasi-nasi—*Psychotria* sp.
47. balam—*Madhuca malaccensis* H. J. Lam.
48. sunti—*Adinandra*, probably *A. acuminata* Korth.
49. pinang utan—*Pinanga* sp.
50. chengkoh—*Mesua ferrea* Linn.
51. bidara pahit—*Eurycoma longifolia* Jack.
52. (without a name)—*Hibiscus abelmoschus* Linn.

53. (without a name)—*Clerodendron paniculatum* Linn.
54. kěchubong puteh—*Datura metel* Linn.
55. (without a name)—*Connarus ferrugineus* Jack.

It is obvious that most of the plants came from gardens in Malacca; others would be found in the untidy ground which surrounded the port and was kept partly cleared that unwelcome visitors might not approach unseen. Only four are actually trees. It is interesting to read a note which calls the Tapioca the best tuber available in Malacca. Of the four races of kěladi (nos. 42–15) local tradition, as incorporated in the names, attributed one to Java and a second to importation by the Dutch. The Greater Yam seems to have attracted less interest; and the Lesser Yam (no. 32) seemed to the writer of the notes to need this comment—"a most excellent vegetable partaking of the yam and sweet potato"—as if it were unfamiliar. Only one race of the Sweet potato is figured and that a curious one. Of 'greens', pēnggaga alone obtained a picture. The pictures of the Zingiberids are praiseworthy representations of flowerless, and, in general, not fully grown plants; and Jack would be helpless in face of them. The plants of magic in medicine,—gēndarusa (no. 8), tutup bumi (no. 11), lēnjuang (no. 14) and *Clerodendron paniculatum* (no. 53)—are pictured, the first in its dark form, because the dark is reputed to be the more powerful; so too lēnjuang is figured in its deep claret form. It is interesting to observe tutup bumi drawn as if from garden soil, whereas tutup bumi in order to possess the pentacle of Solomon's seal should be grown on sun-dried hard soil. Of medicines that every Malay uses without any harm to himself, sērulai laut (no. 1), lēnggundi (no. 5), ati-ati (no. 25), hujan panas (no. 6) and balek angin (no. 3) are figured; and so are potent drugs as Croton and Datura. Farquhar's title 'Medicinal plants etc.' is justified.

The use of sunti for Adinandra is unexpected. The name nara pusi appears in R. J. Wilkinson's Malay-English Dictionary (1932, pp. 165 and 292) as of an unidentified plant. It is now possible with reasonable certainty to equate it with *Voandzeia subterranea*, the Bambara Groundnut, though the Chinese artist did not draw the secondary venation in the leaves correctly, made the runners unduly thick and had neither flowers nor the characteristic pods which the plant buries in the soil. Arab traders probably brought the seeds to Malacca, and Zanzibar was a likely source.

## FLORA MALESIANA

This promises to be the greatest undertaking of its kind ever achieved. The number of species of higher plants to be described in the whole Malaysian region is estimated at 25,000 to 30,000. The largest comparable work previously accomplished was the Flora of British India, which included about 14,000 species.

The sample part already published gives indications of the scope of the whole. First we have the beginning of the essay on general considerations which is to introduce Vol. 4. This is headed with the remark "we should endeavour to determine how few, not how many species are comprised in the Malaysian Flora". Copious quotations are given from Hooker's introductory essay to his Flora Indica, as Dr. van Steenis believes that the considerations there presented by Hooker still largely hold good today. In particular, Dr. van Steenis emphasizes the great need for monographic treatment of all groups, without which no proper judgement of individual species can be made. He goes on to survey variation among Malaysian plants, its many causes and manifestations; first variations induced by the environment and then those bound to the genotype are discussed. He is strongly of opinion that a narrow concept of species is neither in accordance with the modern genetic viewpoint nor with the best practical interests of taxonomy.

Next come the first 39 pages of taxonomic revisions, beginning the text of Volume 4. The two-column arrangement for the individual descriptions of species, in smaller type than the main family and generic headings which cross the whole page, is convenient and excellently set up. The details of the arrangement are to be standardized for all families, and provide necessary information compactly and adequately. One would like to see some more brief notes on the probable affinities of small families to larger ones, such as that given by Dr. van Steenis himself for Ancistrocladaceae; also notes on the basis of classification within the larger families. The illustrations are good and excellently reproduced, but in a few cases details of flowers are not given. It is most desirable that small drawings to show floral structure should be given in at least one species in each genus. Drawings to show details of floral parts would for example be a helpful supplement to the excellent line drawings showing external form of plants in Burmanniaceae.

The publication concludes with brief samples of treatment of Volume 1 (Malaysian Plant Collectors and Collections, a Cyclopædia of botanical exploration in Malaysia), Volume 2 (Malaysian Plant Life) and Volume 3 (Malaysian Plant Geography). These three volumes together will form a most comprehensive introduction to the study of the Malaysian flora.

This great work could only be accomplished by co-operation of many botanists in many different countries. But it needs also a co-ordination of design for which one person must in the main be responsible. The whole work is largely due to the vision of Dr. C. G. G. J. van Steenis, and it is fortunate that he has also been enabled to undertake the co-ordinating work of General Editor. To his unremitting labour no less than to his breadth of knowledge is due the successful launching of this great enterprise. To the Government of Indonesia also much credit is due in these difficult times for undertaking a long-term project, and for recognition of its great importance as a survey of the plant life of the Malayan region.

The Malay Peninsula, which is included in the area covered by Flora Malesiana, will also benefit from this work. We are at present helping by loan of specimens from the Singapore herbarium, so that monographers may have an up-to-date local knowledge of available data concerning the plants they are studying. We hope also that some monographic study may be undertaken in Singapore.

We welcome the appearance of the first issue of Flora Malesiana, which is an outstanding event in the history of tropical botany, and express our congratulations to the Editor and our good wishes for the future success of his efforts.



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